Richard Reece

EXTRACTS

FROM THE ANNUAL REPORT OF THE

MEDICAL OFFICER

OF

G B.

THE LOCAL GOVERNMENT BOARD

1884

For 1884.

1. VACCINATION AND PUBLIC VACCINATION.

2. SMALL-POX AND VACCINATION.

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LOCAL GOVERNMENT BOARD

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EXTRACTS FROM THE ANNUAL REPORT

OF THE

MEDICAL OFFICER OF THE LOCAL GOVERNMENT BOARD (DR. BUCHANAN).

For 1884.

MEDICAL OFFICER'S REPORT.

I.—VACCINATION AND PUBLIC VACCINATION.

Vaccination officers' returns for 1882. (App. No. 1.)

(*a.*) The annual returns of vaccination officers under the Act of 1871 have been examined for the twelfth time, and the analysis of them is appended (App. No. 1). They show that of the children whose births were registered in England and Wales during the year 1882, 763,525 or 85·9 per cent. had been successfully vaccinated at the date up to which the returns are made.* Allowance being made for the children who had died before that date, the returns give evidence of about 95 per cent. of the infantile population having received the benefits of vaccination within the first year or so after their birth. As this is approximately the usual average, it follows that the younger

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* Of the children recorded in any return as "successfully vaccinated," some are dead at the date of such return, having died after their vaccination, and these deaths would not appear in the return :—wherefore the actual number, 763,525, of the present return does not profess to be the precise number of children born during 1882 and vaccinated and living at the time the return is made up. Similarly the number of those recorded as "remaining unaccounted for" at the date of any return includes a certain number of children who have died, but of whose death the vaccination officer has no knowledge, and also a certain number of children who have been vaccinated, but of whose vaccination the vaccination officer has no certificate :—wherefore the actual number, 35,423, of the present return does not profess to be the precise number of children born during 1882, and unvaccinated and living at the time the return is made up. But for practical purposes of comparison with each other, the foregoing two figures afford a just estimate of the relative additions of vaccinated and unvaccinated made, at the time of the return, to the infantile community of England and Wales by the births and vaccinations of 1882.

A 2

English population is made up of not less than 19 vaccinated to each unvaccinated individual, a fact which should always be kept in mind when the numerical incidence of small-pox upon the one and the other class is under consideration.

The returns of 1882, though giving results almost identical with the average of 1878–82, yet, as compared with the returns of 1881, show a slightly larger proportion of "cases not finally accounted for" in the vaccination officers' books. The increase is principally observable in the metropolitan unions, and it is an increase above 1881 only; with the exception of that year, the return for 1882 is the best that has ever been presented by London.

Metropolitan.

There is instruction in these recent metropolitan returns. Neglect of infantile vaccination, represented by the figure 7·1 in 1877 and 1878, increased in 1879 to 7·8, and in view of this increase fresh endeavours were made to ensure obedience to the law, with the result that the 7·8 of 1879 became materially reduced in the two following years. The year 1881, however, was a period of epidemic small-pox in London, and the endeavours of vaccination authorities and their officers were aided by the solicitude of parents to obtain for their infants the protection which vaccination confers. The "cases not finally accounted for" fell in that year to 5·7 per cent. of registered births. But no sooner is the epidemic over than, among a certain class of people, this solicitude is exchanged for an attitude of indifference and of content to postpone a duty which can, these people suppose, be just as well fulfilled some other time. Among them, accordingly, in 1882, the aid afforded to the law by fear of small-pox has disappeared, and neglect of infantile vaccination is measured by the larger figure 6·6; of which it can only be said that it represents a certain good progress in the operation of the usual agencies for procuring and registering infantile vaccination in the metropolis.

Vaccination census in St. Pancras.

I take leave in this place, with an object that will immediately be apparent, to make a digression for the purpose of quoting a vaccination census recently taken in the parish of St. Pancras. This census was taken by skilled enumerators under the instructions of the guardians acting as vaccination authority for the parish. It took account of 142,788 individuals, being about three-fifths of the total inhabitants, the remaining two-fifths being persons who were away from home at the moment of inquiry. There was no reason for supposing that the facts about vaccination ascertained for the three-fifths did not truly represent the facts for the whole. Information was refused to the enumerators in the case of 1,168 persons only. Now, of 3,278 infants under one year old medically examined for the purpose of this census, closely 60 per cent. were found to have been successfully vaccinated; 11 per cent. had been vaccinated, but had not at the time been officially inspected; and 29 per cent. had not been vaccinated, the majority of these last being children under three months of age.* Next, of children over one year but below ten years of age, 25,917 were examined, and of these over 98 per cent., or including a few under vaccination, over 99† per cent. had been vaccinated.

What is of present value in these statistics of children actually living in St. Pancras is the fact that they take account, in a way that vaccination officers' returns cannot do, of children whose births may have escaped record, and of those born outside the parish. The vaccination officers' returns respecting the vaccination of children whose births were registered in St. Pancras in 1882 were made up at the beginning of 1884, and they finally accounted for no more than 94·3 per cent. of those children. Hence, if anyone should think of unregistered and immigrant children as adding to any material extent to the actually unvaccinated portion of the juvenile community of St. Pancras, a comparison of the figures with those of the house-to-house census will give him the means of correcting his impression; and this is my principal object in quoting the recent enumeration.‡

[The account thus far given deserves to be completed by mention of the people over 10 years of age. Of these, 112,425 were examined; nearly 99 per cent. of them were found to have been vaccinated, and about 1¼ per cent. not to have been vaccinated.§ Of the 111,048 persons over 10 who had been vaccinated, 2,042, or about 19 per 1,000, were seen to be scarred by small-pox, while of the 1,377 who had never been vaccinated, no less than 857, or 622 per 1,000, bore scars of small-pox on their faces.]

Public vaccination.

(*b*.) The vaccination which is gratuitously provided by the State, and which is had recourse to by about two-thirds of those English parents who require vaccination for their children, has continued to be administered by the guardians of the various unions, acting under the advice and direction of the Local Government Board. The working of this "public vaccination" has been, during 1884, the subject of examination by the Board's medical inspectors in 1,099 vaccination districts comprised in 245 unions. Awards of money were made from the Parliamentary grant to 729 public vaccinators who were reported by the Board's inspectors as having performed the whole of their duties in a satisfactory manner.

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* These figures would be changed to 56, 10½, and 33½, if we should suppose that all infants respecting whose vaccination information was refused were in reality unvaccinated.

† This figure would be changed to 96 or 97, if we should suppose that all children between 1 and 10, about whose vaccination information was refused, were in reality unvaccinated.

‡ A similar census recently taken in West Ham Union just beyond the metropolis, tends to almost identical conclusions. The results, however, are not so exactly recorded as in the case of St. Pancras.—The characters of the vaccination were in a certain proportion of the St. Pancras cases unsatisfactory, but this consideration is not in question here.

§ This figure would be raised to 1½, if the persons over 10 years of age who refused the information were to be reckoned as unvaccinated persons.

Public vaccinators are, as a body, found to operate efficiently and with proper care and judgment: and their stations are frequented, not by the poor only, but by other people who have learnt the importance of having vaccination performed under the most advantageous conditions. I have shown in a recent Report (1881) that in London the vaccination given by public vaccinators afforded a greater protection against epidemic small-pox than the average vaccination of the town, and I now reprint that evidence in Appendix No. 4.

National Vaccine Establishment.

(*c*.) The National Vaccine Establishment of the Board, for the supply of lymph to vaccinators, public and private, who are proposing to establish local series of vaccinations, has continued its operations in the customary way, and since July 1884 has added to its business the function of supplying lymph (in a preserved state) for the use of the Army Medical Service. The Establishment has received from certain approved operators in various parts of the kingdom supplies of selected humanized lymph; it has made careful examination of this lymph, and has rejected all to which objection might be taken; and has distributed 2,614 points and 13,090 tubes to 9,677 applicants. It has also received from the Board's Animal Vaccine Station 13,139 points and 114 tubes charged with calf-lymph, and has distributed the tubes and 7,578 points to 1,770 applicants. Further, the Establishment has supplied to the Army Medical Department 1,452 tubes of humanized lymph, and 5,432 points of calf-lymph.

Animal vaccine.

At the Board's Animal Vaccine Station situated at 95, Lamb's Conduit Street, the primary vaccinations, which had numbered 1,294 in the previous twelvemonth, increased to 2,915 in the year ended March 31st, 1885; the increase being doubtless largely due to the incentive furnished by a small-pox epidemic. Owing to the same cause, there was an unusual demand for re-vaccination; and for some months a supplementary station was at work to meet this requirement.

The supply of calves has been on the whole satisfactory. A valuable improvement in the practice of the station has been made by keeping each animal for a week before its transfer to Lamb's Conduit Street under observation and fed upon appropriate food, at premises in Somers Town. Through this precaution, originally adopted for the sake of avoiding foot-and-mouth infection, the ailments that used often to trouble the calves while under operation are now seldom met with, and the course of the vaccine disease is rendered more regular.

The success of calf vaccination on children has been all that could be desired; and has been practically identical with that of vaccination with humanized lymph in the hands of the same operators. Dr. Cory tells me that he has produced 985 vesicles, and that the Assistant Director has produced 991 vesicles for every thousand insertions of calf-lymph which they have respectively made on infants. This experience is of course with lymph used in a perfectly fresh state. The "keeping" qualities of the lymph are at present matter of observation by Dr. Cory.*

Degree of risk attending vaccination.

(*d*.) I wish again to note the extent of the danger that accompanies vaccination under the circumstances of English vaccination practice. There is little that man, woman, or child has to do, or to have done for them, that does not contain an element of danger; but reasonable people, while endeavouring to remove all preventable risk, do not regard this risk as a reason for not doing what is proper to be done. For example, I find from the last published annual report of the Registrar-General that 974 children under one year old were suffocated in a twelvemonth by bedclothes; the fact gives a reason for care in the use of bedclothes, but gives no reason for going without them. So, 55 deaths (51 being of infants under one) were recorded in that report as from vaccination and the results of vaccination; they doubtless were for the most part cases of erysipelas, and their occurrence gives reason for cleanliness of lancets, for avoidance of filthy "vaccination shields," and generally for care in vaccination; but it assuredly gives no reason for going without vaccination. When we learn from the same report that five infants died in the same year from "circumcision," the dimensions of the danger implied in the 55 deaths by "vaccination" may be understood.—As for any remoter injury to the health of the community, attributable to vaccination as practised in England, I can find no evidence of it, statistical or other.†

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* It deserves notice that the rate of success in vaccination obtained at the Board's stations, where vaccination is done with perfectly fresh lymph, human or animal, is not less than 99 per cent. *of the individuals* operated on. This rate of success is nowise to be had when the lymph is used in any preserved condition. Thus I find from the Report of the Army Medical Department of 1882 (pp. 17–18), that of 641 attempts at vaccination of recruits who had never before been vaccinated, no less than 166, or 26 per cent., "failed" altogether, and another 219, or 34 per cent., had "modified vaccine pustules" only. There remain only 40 per cent. of completely satisfactory primary vaccinations; and, among the reasons for the great difference between this figure and the 99 per cent. of the Board's stations, the condition of the lymph—whether taken direct from a vesicle or preserved in any manner—unquestionably is one of the most important.

† I note in this connexion, valeat quantum, that erysipelas generally is contributing to the English death-rate to a smaller extent than 30 years ago.—Referring to two diseases which have been supposed to have become more fatal during the time that vaccination has been compulsory, and to have been increased by the practice of vaccination, I do not think it necessary to speak at length of *tubercular* diseases of children. The small increase of deaths registered as "tabes mesenterica" has been balanced by a decrease in the deaths of children under five registered as from "phthisis," the death-rate from the two together having kept very closely uniform, and the changes in registered mortality of the one and the other being obviously a question of which of certain synonyms is used in medical certificates. As well might an increase of "intemperance" be ascribed to vaccination, because x deaths per million living certified as due to this cause in 1850–54 had increased to y deaths in 1875–9, while y deaths per million living certified as due to "delirium tremens" in 1850–54 had decreased to x deaths in 1875–9. But as this consideration of changed nomenclature is not so immediately seen in the case of *syphilitic* disease, I may usefully say a few words as to an apparent increase of mortality registered from that cause. The appearance of increase dates from 30 years ago, since which time the rate of mortality registered as from syphilis has been practically stationary. Now, it is just about 30 years ago that the English medical profession began to understand the syphilitic nature of a

Alleged injuries by vaccination during 1884.

Investigation has been made by inspectors of the Board's Medical Department into fourteen cases where vaccination was believed to have produced some injurious effect. The allegations of injury came from a variety of sources and were usually of very indefinite character. One of them proved to be an example of careless vaccination by a private practitioner, resulting in undue irritation of the arms of several children. The rest of the complaints referred to single children, and in two of these instances only did there appear reason for connecting the child's complaint with its vaccination; one was the case of a child whose arm had been dressed by its mother with brown paper and cobbler's wax, and who got an axillary abscess in consequence: another case was a slight eruption of the skin following vaccination. There was a third case where the healing of vesicles had been delayed, and it was thought possible that one of the reputed syphilitic vaccinations had been detected; but the child had been vaccinated with calf-lymph, and calves are not known to be syphilitic. The above fourteen were all the allegations of injury from vaccination that reached the Board during a period in which some 750,000 children were vaccinated.

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number of obscure diseases, and to record syphilis as the primary cause of death in such cases. Many a death that would formerly have been certified as due to "atrophy" or "debility" in infancy, or to "brain disease" in adult life, has during the last 30 years been registered as having syphilis for its "primary" cause, the former vague term appearing (if at all) as the "secondary" cause. Accordingly, the numerical abstracts, which take account of one, and that the more essential cause of death, contain record of more deaths from syphilis than they formerly did. But there is no reason for believing that, in point of fact, syphilis has become more common or a more frequent cause of death in the English community. Nor, if we should believe it to be so, would there be any reason for connecting the increase with the increased practice of vaccination in England.

As matter of English practice, with all the opportunities for knowledge that come to me, and with an eagerness of search after the facts, I cannot learn of communication of syphilis in vaccination being actually effected once in a million of vaccinations.

II.—SMALL-POX AND VACCINATION.

Small-pox in its relation to vaccination.

Small-pox was prevalent during 1884 in a good many towns and districts of England, showing, as usual, a higher death-rate in London than in the rest of the kingdom; and I propose to take this occasion to consider at some length the recently observed relations between small-pox and vaccination, more particularly in the experience of London.

In London in 1884 and other recent years.

The actual mortality from small-pox in London in the 53 weeks of 1884 was 913 deaths registered as occurring in houses and hospitals within the metropolis, and 338 registered as occurring among London residents removed for treatment to hospitals beyond the metropolitan boundaries. Together, these amount to 1,251 deaths, or 313 per million inhabitants of London, a notable excess over the mean annual rate (240 per million) of the preceding 10 years. Recent more distinct "epidemics" in the metropolis have given the death-rates of 620 in 1881, 390 in 1878, 710 in 1877; and the very severe epidemic of 1871, the largest experienced by the metropolis since registration began, was accountable for a death-rate of 2,420 per million: on each of these recent occasions the rate of death was much larger in London than in the provinces. In non-epidemic years the death-rate in the Metropolis has subsided even to 15 and 11 per million (1874 and 1875): and in the provinces to 6 and 11 per million (1879 and 1880).

To state these facts in another way: small-pox, which on the mean of 1874–83 contributed 11 deaths to every 1,000 deaths from all causes in London, was responsible for 15 deaths during 1884; while in the epidemic year 1881, it caused 29; in 1878 it caused 17; in 1877 it caused 33; and in the severest epidemic of 1871 it caused 98 deaths out of every 1,000 from all causes in the metropolis. In the non-epidemic years just quoted, the contribution of small-pox to total mortality has fallen to 0·7 and 0·5 in the metropolis; to 0·3 and 0·5 in the provinces.*

In London during last three centuries.

I have reproduced in an appendix to this Report (No. 5, p. 9) the Statement from the Yearly Bills of Mortality delivered in by Dr. Lettsom to the Committee of the House of Commons appointed in 1802 to consider Dr. Jenner's petition to the House;

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* The plan of estimating the relative mortality from a given disease by taking its death-rate upon a known population is, on many grounds, to be preferred to the method of taking its proportion to total mortality. The former plan is now, thanks to our excellent registration system, available everywhere in England, and when we have to compare mortality at one and another place during the same period or at the same place during the last half century, we of course consider the rate of death by the disease upon the population. But when it is desired to examine the varying mortality from a particular cause, in the same place during a long period, including times before registration existed and before censuses were taken, a good way of appreciating the changes in its fatality, one that serves for most practical purposes, is to note the share of total mortality that is borne at one and another time by the cause in question.

As I am referring in the text to small-pox mortality in London during the 17th and 18th centuries, I have here used both of the above methods of indicating the recent intensity of the disease in London.

and I have brought the series of figures down to the present time (pp. 32–33). They show the share of London mortality borne by small-pox in successive years during the last three centuries.

The recent average contribution of small-pox to total deaths is less than a sixth of what it was in the 17th century, about an eighth of what it was in the 18th. The maximum contribution of which I have spoken as having been recently made by small-pox to the general mortality of London (viz., in the great epidemic of 1871) was during the 17th and early 18th centuries exceeded every five, ten, or twenty years; and it was no more than the customary yearly contribution made by small-pox during the latter half of the 18th century when inoculation was in vogue. As for such petty yearly contributions as one and two per thousand, they would formerly have been regarded as Utopian, not even to be hoped for.

This reduction of the customary amount of fatal small-pox in London to a sixth and an eighth part of what it used to be (as measured by the contribution of small-pox to mortality from all causes) is unquestionably attributable to the general use of vaccination;* but it is not a complete fulfilment of the anticipations of those who at the beginning of the century saw the protection that vaccination was able to confer upon the individual. Yet the gain to be obtained by the community from vaccination is even more demonstrable to-day than it ever was.

Small-pox mortality at different periods of life:

In a notable passage in his 43rd Annual Report (here reproduced in Appendix No. 6), the Registrar-General says: "In discussions concerning the protective influence of vaccination, "too exclusive attention is usually given to the change that has "occurred since its introduction in the death-rate from small-pox "*at all ages*. It is important" he points out "that not only this, "but the changes in the death-rate *at successive periods of life*, "should be taken into account." And inasmuch as, during the whole period for which such investigation is possible, vaccination has always been in use, and there has always existed some or other public provision for its gratuitous performance, there are no means, the Registrar-General says, of comparing with precision the small-pox rates at different age-periods before and after the introduction of vaccination. Recognizing this, he proceeds to examine the differing mortality from small-pox in divisions of the period of 33 years last past, during which there had been notable changes in the extent to which vaccination had been used by the public and in the nature of the State provision for ensuring its performance. I shall presently have to use the information he supplies.

Now it is true that there do not exist the means of comparing with the precision desired by the Registrar-General the small-pox death-rates at various age-periods before and after the introduction of vaccination. But reasonably accurate measure of any change that has taken place, between the past and the present, in the incidence of small-pox mortality upon one and another age may be got by an examination of the records of small-pox among communities which, although they do not furnish the material for differential age death-rates, yet have recorded the facts about age at death in the case of this disease.

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* The Registrar-General, in the passage quoted in the Appendix (page 35), disposes of a belief which some people have entertained, that improvement in drainage, water-supplies, and like sanitary conditions is to be credited with the observed reduction of small-pox fatality.

in former centuries,

In former centuries, out of a thousand persons dying from small-pox, some 800 would have been children under 5 years of age, and 150 of the remaining 200 would have been between 5 and 10 years of age.* I do not know whether in any community these proportions were ever materially smaller. I have not been able to find an instance, though I can find cases where infants suffered in still larger proportion.

in nineteenth century,

In the present century, and after registration began, the share of total small-pox mortality borne by English children under 10 did not at first greatly decline from its former amount; children under 5 continued to furnish about 700, and children between 5 and 10 about 130 deaths to every 1,000 small-pox deaths at all ages. When Mr. Simon, in his "Papers" of 1857, took stock of our vaccination experiences, the reduction of the share borne by children was discernible in English records. That descending series of figures which (in the absence of vaccination) had formerly testified to the almost exclusive incidence of small-pox on children, and to the protection against death by second small-pox afforded to those who survived, had now become interrupted by a rise in that part of the series which showed the proportion of deaths borne by adults, particularly by a rise in the figure for ages 20–30. This interruption of the regular descent in the series of figures that showed the small-pox mortality of England at successive periods of life was more visible in the metropolis than in the provinces. Mr. Simon found occasion to observe that the degree of this reduction in relative infantile fatality was far more conspicuous in the Paris than in the London records. In Paris, so early as 1842–51, the children under 5 were no longer bearing four-fifths of the gross small-pox mortality, but only about one-third; the rest of the deaths being contributed by people of higher ages, but most conspicuously by young adults between 20 and 30 years old.

in Paris.

Significance of change of incidence as regards age.

For explanation of this altered incidence of small-pox upon persons of one and another age, there was of course in the first place the arithmetical consideration that, of necessity, any insusceptibility given preponderatingly to the infants of a community meant (so long as any small-pox continued to exist) a corresponding increase in the proportionate contribution made to the small-pox death register by adults. This consideration sufficed in the case of London, but did not suffice in the case of Paris. For Paris, when contrasted with London, a further explanation of the displaced incidence of small-pox mortality was required; and Mr. Simon regarded it as meaning a loss by the individual, as he grew up, of the protection afforded by vaccination in infancy. The increased proportion of young adult small-pox in Paris was such as to mean post-vaccinal small-pox; and the age-period in which the increase began to be observable showed the age at which the vaccination which had protected during childhood against the current small-pox was losing its ability to protect the average individual during later periods of life.

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* See Mr. Simon's Papers relating to the History and Practice of Vaccination, p. xxix and following pages and diagrams; also, in Appendix (A., No. 7) to the present Report, extracts from an "Inquiry," by Dr. M'Vail, "into the Prevalence of Small-pox in Kilmarnock in the last Century." I may here note, from a lately published old record belonging to the University of Cambridge, that in an epidemic year, 1774, in the city of Chester, out of 202 deaths by "natural small-pox" at all ages, 180 were contributed by children under 5, and all the remaining 22 by children between 5 and 10 years old.

The difference between London and Paris in this respect was to Mr. Simon a very startling circumstance. It appeared to indicate a different protection, in the two cities respectively, afforded by the current vaccination against the current small-pox of each. The contrast was such as to suggest to Mr. Simon the question whether it might be dependent on anything peculiar to the French administration of vaccination; and he commends to the critical consideration of the French authorities the question whether the vaccine lymph of Paris was of the same good quality as in London.

Decrease in share borne by infants in English experience.

Since 1857, as time has gone on, it has been observed that in England the share of small-pox mortality borne by children 0–5 years old has steadily decreased in amount. In the evidence which I had to give to the Royal Commission on Hospitals in 1882 I showed this contribution falling by successive steps from its 700 out of every thousand deaths at the commencement of registration to 560, 550, and 540 in the several five-year periods 1855–9, 1860–4, and 1865–9; and then in the two five-year periods 1870–74 and 1875–9, to 320 and 280, the amount of infantile contribution always keeping very closely the same in London and in the provinces. In the metropolitan small-pox of 1884, the share of small-pox mortality borne by children under 5 has been only 240 out of a thousand deaths at all ages; and another hundred deaths out of the thousand have formed the contribution of children between 5 and 10 years.

The reduction is of course in the first place to be regarded as an expression of the arithmetical fact to which attention is above called: namely, that the insusceptibility to small-pox gained by the English community has, during recent years and by the influence of recent legislation, been gained in preponderating measure by the infantile section of the community; wherefore the peculiar incidence of small-pox on the early years of life has to an increasing extent been reduced, and later periods of life are contributing more and more to each thousand deaths by the current disease.

Increase of rate among adults.

We wish, however, to ascertain not only whether grown-up people are contributing a larger share to the prevailing small-pox mortality of the time; but also to learn whether they are really dying from small-pox in larger numbers than formerly, and if so, at what period of life the increase is discernible. With the object of learning this further lesson, the method of observing the proportion of mortality borne by different ages must be abandoned, and we must recur to the records of *death-rates of persons living at each age.* The Registrar-General, as I have said, divides the period 1847 to 1880 (during which the causes of death were abstracted in combination with ages) into portions; a first, namely, of six years 1847–53, when vaccination was optional; a second of eighteen years 1854–71, when it was obligatory but not efficiently enforced; and a third of nine years 1872–80 when it was obligatory and more efficiently enforced by vaccination officers. For England and Wales the mean annual death-rate from small-pox of children under 5 years old in these three several periods fell from 1,617 per million, at which it stood during the period of optional vaccination, first to 817, and then to 323; and the death-rate of children between 5 and 10 years fell in a similar way from 337 to 243, and then to 186. The rates for children between 10 and 15 years in the three successive periods of time have remained without much change, having been 94, 88, and 98. At higher ages of life to which I shall immediately recur there has not been decrease but increase in the rate of death by small-pox. Nevertheless, when all ages are considered together, the average annual death-rate by small-pox, 305 per million persons living, during the period of optional vaccination, is found to have fallen to 223 during the following period of obligatory vaccination, and during the period of enforced vaccination to 156.

Decrease in all-age rate.

Statutory enforcement of vaccination then, as contrasted with its optional use before 1853, has availed exclusively for the protection of those who cannot protect themselves. People aged between 15 and 25 years, the Registrar-General goes on to tell us, used thirty or forty years ago to die at the rate of 109 per million, and now under the system designed for the protection of their juniors they are dying at the rate of 173. Adults between 25 and 45 years who thirty or forty years ago died at the rate of 66 per million, are now dying at the rate of 141; and persons over 45 years old, instead of dying at the rate of 22 are dying at the rate of 58 per million of their number.

Thus it has become obvious that the transference from infancy to later ages which we have noted as observable in the age-incidence of small-pox mortality in England and Wales is not wholly an affair of abolition of infantile small-pox. There is something more than this wanted to explain an increase in the actual death-rate by small-pox among English adults.

Significance of increased death-rate in adults.

Conducing to an increase in the registered annual death-rates between the first and second period of the Registrar-General, I find two circumstances that deserve mention. These are, first, the probability of small-pox death-rates among adults having been artificially low during the Registrar-General's first period 1847–53; an exceptional number of the men and women of that time having very recently passed through their primary vaccination; and secondly, the increased mobility since the end of that period of the population, essentially of the adult population, which has brought grown-up people ever more and more into towns and into contact with the infectious diseases that find their homes specially in towns. These considerations may, I believe, account for a part, but only a part, of the increase in the small-pox death-rate observable in adults since 1853, the date at which the decrease in the death-rate of children began, thanks to the legislation of that year, to be conspicuous.

The Registrar-General, in the passage I have reprinted from his forty-third Annual Report, explains this recent increase in the actual rate of small-pox mortality among adolescents and adults in England by reference to the following consideration. It is to be observed, that the security against small-pox afforded by an attack of *small-pox* in infancy, though not absolute, does most commonly last through the whole of life. For evidence of this among communities, witness afresh the extremely small fraction of small-pox mortality borne by adults last century, and the perfect regularity observable in old records, in that declining series of deaths, which shows the contributions made by people of successive age-periods towards the general mortality of the disease. The resistance to adult small-pox, formerly afforded by an infantile attack of small-pox, was almost complete and life-long. It has been exchanged now-a-days by a larger number of people for the resistance furnished by the average English *vaccination*. Without reference to changes that may have occurred in this average vaccination between one and another epoch, we know of it that for many people it is of chief avail for the first years after it has been gained, but gets measurably forfeited as age advances. The Registrar-General points out that those who have grown up in recent years in our English communities have in increasing numbers exchanged the life-long protection conferred by surviving an attack of infantile small-pox, for the protection, less durable in their case, furnished by the average vaccination of the Kingdom; and he finds in this consideration the explanation of the circumstances that only 22 deaths per million occurred from small-pox 30 years ago among people past middle life, whereas 58 deaths per million would now-a-days occur among people of the same age. According to this explanation, 30 years ago English adults were in larger numbers the survivors of an infantile community which had passed through small-pox, paying an enormous tribute of deaths, but by their survival acquiring a more durable protection against subsequent death by small-pox than the same number of adults would have received from an infantile vaccination.

Your medical officer has inevitably some misgiving as to accepting this explanation of increased small-pox mortality among adults, allowing him to look on post-vaccinal small-pox as a necessary and constant quantity, though manifesting itself to a greater extent as time passed on. To one who fills the office which I have the honour to hold, the likelihood of change in the protective power of English vaccination between one and another epoch must needs be an element of the problem. We know too well that what is called "vaccination" may be of various characters, the one differing from the other in influencing the recovery of persons attacked by small-pox; and the question, as it presents itself to us, must needs be similar to that propounded by Mr. Simon in respect of Paris 40 years ago. It has of course reference to past times: was there, during the successive periods in which these English adults received their infantile vaccination, any deterioration in the vaccination procedures of the kingdom, of a sort to account for the later born possessing, as they grew up, an inferior degree of protection against small-pox than had been possessed by the earlier born? In answer I may say that not improbably there was something of such deterioration in successive decades before vaccination was made a matter of State concern and before those measures began to be taken under the auspices of the General Board of Health that had for their object to secure throughout the country the efficient performance of the operation.[*] But while recognising this probability, I see that the time has not yet come for statistical evidence whether the present vaccination of the country is for the individual a more durable protection against small-pox than that given to the infants of twenty or thirty years ago.

I find, however, that I may confidently say from the recent experience of my department that infantile vaccination in England is being carried out far more intelligently than in the times to which I have adverted, and year after year with increasing solicitude; that public vaccination is as a rule excellently performed, and much private vaccination also; so that, after all deduction for those bastard operations of which I have had to speak with reprobation,[†] the average vaccination of the country is making good progress towards its proper standard.

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[*] Claiming consideration equally with a possible diminution in vaccine protection is the question of a possible intensification in the current small-pox of the country. As regards this, there are not wanting indications of a recent malignity and fatality of the disease, among unvaccinated and vaccinated persons alike, in excess of that which was customarily observed in English small-pox 30 or 40 years since. Some evidence on this head, important in the present connexion, was given to the Hospitals Commission of 1881 by Dr. Munk, one of the physicians to the Highgate Small-pox Hospital; and the question will arise for further consideration in a later part of this report. The Registrar-General, indeed, offers this increase in malignity as an alternative explanation for the acceptance of those who may be dissatisfied with the other hypothesis which he brings forward concerning the increase of adult small-pox mortality; and he points out that, if we must believe small-pox itself to have become more virulent, it is plain that the saving of life due to vaccination has been even greater than hitherto supposed. "For not only did the small-pox death-rate fall with its "extended use from 305 per million to 156, but it so fell in spite of an increased "intensity of the virus which would, if unimpeded, have enormously increased the "mortality." (43rd Report.)

[†] In Report of 1881, reprinted in Appendix No. 4.

Need for re-vaccination.

It is to be regretted that all who apprehend the fact that small-pox continues to prevail in England, having largely transferred its fatal incidence from the period of infancy to a later time of life, do not, instead of decrying the agency which has preserved through childhood, accept and urge on others to accept that renewal of protection that may be had by a second vaccination. The English vaccination system, though it provides facilities for renewal of the vaccine protection at puberty, does not provide for any second enforcement of the operation, but leaves the adult to decide whether, in his own interests, he will receive the full measure of protection that vaccination is capable of giving him. Yet in the case of some people there is a period of life between childhood and manhood, before the age of legal responsibility is attained, in which period the protective influence of their infantile vaccination is so far lost as to leave them liable to small-pox, and in some instances to death by small-pox. The German legislature, in enacting its compulsory vaccination law of 1874, had regard to this fact, and considering that the protective influence of vaccination might reasonably be trusted for 10 or 12 years from the time of operation in infancy, directed that all children should be vaccinated a second time during their school period, and made the parent of the child responsible for this being done.

German experience of re-vaccination.

An important report on the influence of this law upon small-pox prevalence has recently been made by a German Vaccination Commission, and it is there shown that during the 10 years last past Germany has not only experienced smaller death-rates by small-pox than ever before, but even has passed from a position of inferiority to England into a position of distinct superiority, as regards its immunity from the disease, and it would appear certain* that this result has been brought about through the working of the compulsory re-vaccination law of 1874. In the large towns of Germany, since that date, small-pox death-rates have become actually trivial, whereas in London, Paris, and Vienna there have been several appreciable epidemics, in the case of London, as we have seen, having to an unusual degree their fatal incidence upon young adults.

Respecting the renewal of protection which people can, if they please, obtain by a second vaccination, the familiar experience of nurses in small-pox hospitals hardly needs to be quoted afresh; but it may here be mentioned that in the great majority of the instances where small-pox has attacked people employed about small-pox hospitals, it has been found as the result of recent inquiry, that there has either been chance exception to the rule of re-vaccination, or the re-vaccination was not done until after the individual had received the infection of small-pox.

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* The extent of the protection afforded to the German adult community by this enforced re-vaccination of individuals cannot indeed, as yet, be exactly measured; but there would appear to be no question of its having been considerable in amount.

Re-vaccination in Army and Navy.

As regards Army and Navy re-vaccination, it is shown by a return to Parliament made in 1884, on the motion of Mr. Burt, and reproduced in the Appendix to this Report (No. 8), (1) that in the Army the mortality by small-pox has become greatly lessened as the Order of 1858 has come to have more and more effect: the death-rate is now materially below that of the civil population of the same ages; and (2) that in the Navy the death-rate by small-pox has been reduced since the operation of the Order of 1871, to a third of the amount at which it stood before re-vaccination was required: the small-pox death-rate of the Navy had previously been in excess of that of the civil population and of the Army. I have no further information respecting small-pox in the Army; but in this connexion the note on page xi. of the present Report should be considered. As regards small-pox in the Navy, the 43 deaths shown by Mr. Burt's return to have occurred in that service in the 11 years following the Order of 1871 are found, on reference to the reports of that Department, to be made up of 13 persons who were vaccinated once and once only; of 12 persons (including 11 Kroomen) who had never been vaccinated at all; of 12 persons (including 2 foreigners) about whom no information was to be had; and of 6 persons who had presumably been successfully vaccinated and re-vaccinated. These were the small-pox deaths occurring during 11 years on a mean strength of nearly 60,000 men.

London small-pox in 1884.

Reverting to consider more particularly the statistics of London small-pox mortality in 1884—in a page appended to this Report I give a table (Appendix No. 9) based upon facts ascertained for all the fatal cases (1,243 in number*) of small-pox; and in almost all instances ascertained at the instance of your Board by the vaccination officers of London Unions. The facts have been derived in such cases from the parents or relatives of deceased persons, whether or not they were stated in death certificates; and when there could be room for question about the facts of a case, it was recorded with those where the facts were unknown. I have classified deaths of persons resident in London, according as they died at their homes or in hospitals; according as they were found to have been or not to have been vaccinated; and according to their age. These materials will afford to anyone who is disposed to examine the above statements the opportunity of studying for himself the more recent experience of London. From that Appendix I here extract certain age-particulars in relation to vaccination and small-pox in London during 1884, which I exhibit side by side with some corresponding figures to which I have referred in the text of this Report.

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* This number differs by 8 from the 1,251 deaths stated by the Registrar-General to have occurred among London residents after inclusion of those dying in hospitals. The difference is believed to be accounted for by the deaths of eight persons resident beyond London but removed into the Highgate Hospital for treatment.

Medical Officer's Report.

Contribution of various Ages to 1,000 Small-pox Deaths at all Ages.

Ages at death.	Genova, 1580–1760.	Kilmarnock, 1728–1764.	London, 1848–51.	Paris, 1842–51.	London, 1884.		
					Unvaccinated community.	Vaccinated community.	Total inhabitants.
0–10 - -	961	988	815	397	612	86	343
10–20 - -	26½	5	59	133	146	173	170
20–30 - -	10	7	83	329	108	319	213
30–40 - -	2½	—	32	110	72	221	142
40 and upwards.		—	11	31	62	201	132
Total - -	1,000	1,000	1,000	1,000	1,000	1,000	1,000

From the last column of the above table it will be seen that, in respect of the incidence of fatal small-pox on persons of different ages in 1884, the affinities of London have been with Paris of 35 years ago; there is no doubt that the distribution is significant of post-vaccinal small-pox. Further, on separately considering those who were unvaccinated, the incidence of 612 deaths only (out of a thousand at all ages) upon children under 10, is seen to be less than was to be expected from the experience of other columns; but this fact is doubtless connected with the immigration of unvaccinated persons of adult age into the metropolis, in excessive numbers as compared with unvaccinated infants, as will appear in the sequel. Of the 86 deaths out of each thousand contributed by "vaccinated" children under 10, the figure contrasts indeed with the contribution of 612 per 1,000 by the unvaccinated, but the rate of death among such children (remaining at 44 per million of their number) is altogether improperly high and is certainly indicative of that sham vaccination to which I have before had occasion to refer. On a previous investigation of this question, I showed 125 children under 10 dying of small-pox in London after an alleged vaccination, comprising among their number *one only* who had been vaccinated by a public vaccinator and in the manner contemplated by this Board's instructions (see reprint App. No. 4); and as in 1881, ignorant people may still be found to demand and supply a factitious operation, well known to be inefficient yet passing under the name of "vaccination."

Particulars of 1,000 deaths from small-pox.

Once more: on the folded page 31, I have recorded the age at death in each of a thousand consecutive fatal cases of small-pox registered during the epidemic of 1884–85 (as occurring among the inhabitants of London whether at their homes or in hospitals), and I have grouped these thousand figures not only with respect to ages, but also according to the birth-place of the several persons, and according as they were stated by their relatives to have been vaccinated. I have summarized the figures in the short table on page 52. Of this particular thousand deaths, 323 were contributed by children under 10 years of age, the remaining 677 by persons over 10 years of age. My object in distinguishing the birth-place of persons who die of small-pox in London, has been to see how far and at what ages the presence of immigrants has operated to disturb the conclusions as to the population at large derivable from London death-registers. And I find the interesting facts: first, that there have been so few deaths among *immigrant children* under 10 years as to indicate that children of these ages are either not numerously immigrants or are as a body well-protected against small-pox; and secondly, that the *immigrants over* 20 *years* of age contribute in even larger numbers than natives to the actual small-pox mortality of London at their period of life, the vaccinated immigrants of such age adding to the deaths among vaccinated Londoners, and the unvaccinated immigrants of such age adding to the deaths among unvaccinated Londoners in alike excessive numbers.—As regards the infantile population born in London, a judgment of the size of its vaccinated portion and of its unvaccinated portion respectively, may be formed from any recent set of Vaccination Officers' Returns. Out of the thousand deaths in the appended record, 248 were the deaths of children under 10 years who had been born in London and about the facts of whose vaccination there was no dispute. Thirteen of these children are recorded to have belonged to the vaccinated class, 235 of them are recorded as belonging to the not-vaccinated class; the latter class of Londoners being (let us say, for the sake of avoiding all cavil) one-tenth part the size of the vaccinated class. No refinement of statement appears needful to show the meaning of such a difference in mortality. I may mention that of the thousand deaths 92 were in London-born infants under 1 year of age; and 91 of the 92 had not been vaccinated.

As to legislation

Whether or not, in face of the accumulated evidence of the importance of vaccination to children who cannot judge for themselves of its value, it may be expedient to relax those provisions of the Compulsory Vaccination Acts which allow of repeated penalties on such parents as refuse vaccination, is a question which lies within the province of the statesman rather than of the physician to settle. To the physician, who realizes the powers of vaccination and who knows the malignity of the disease against which it protects, the notion of enforcing the acceptance of such a boon is distressful. But the distress is akin to that with which he himself has at times to force nourishment down the throat of a lunatic who is starving himself: and in the case of vaccination he sees that it is for the security of children otherwise helpless, not of the recalcitrant himself, that compulsion is wanted.

In England, however, "compulsory vaccination" never has meant, and probably never will mean, taking a child out of the custody of its parent and returning it to him vaccinated; and if it does not mean this, it may, by some persons, be judged advantageous, in order to avoid gratifying the sheer love of martyrdom that influences the conduct of misguided people, to alter the Compulsory Vaccination Acts in such a way as to limit the number of penalties that can be imposed for disobedience to them. I express no opinion on this proposal; but if it should be adopted, it would appear to be a corollary that the Acts be so further altered as to mark by law the sense of the community that a parent will have committed an offence whose child dies of small-pox without having been vaccinated while in the legal custody of its parent. Such parents will have failed to give the security that the law provides for their helpless children, and will be in the same position as if they had failed to provide their children with any other security important to their lives.

APPENDICES.

APPENDICES.

No. 1.

Digest of Vaccination Officers' Returns.

Digest of the Vaccination Officers' Returns, with regard to Children whose Births were registered in the Year 1882.

The following is a summary of the eleventh annual return under the Vaccination Act, 1871. Of 889,082 births returned to the Board by the several Vaccination Officers in England and Wales as registered during the year 1882, the number which at the time the return was made had been registered as successfully vaccinated was 763,525 (being 85·9 per cent. of the whole), and the number registered as having died unvaccinated was 81,498 (or 9·2 per cent. of the whole). Of the remaining 44,059 children, 993 (or 0·1 per cent. of the whole) had been registered as insusceptible of vaccination; 45 (or 0·005 per cent.) as having contracted small-pox before they could be vaccinated; 7,598 (or 0·85 per cent.) as having their vaccination postponed by medical certificate; leaving 35,423 (or 4·0 per cent.) as "removed," "not to be traced," or otherwise unaccounted for. If from the 889,082 births returned by these Officers deduction be first made of the deaths that took place before vaccination, it appears that of the surviving 807,584 children, there were registered at the time of the return 94·5 per cent. as successfully vaccinated; 0·13 per cent. as either insusceptible of vaccination, or as having had small-pox; and 0·94 per cent. as under medical certificate of postponement; leaving 4·4 per cent. as at that time still unaccounted for as regards vaccination.

The proportion of cases unaccounted for in the metropolitan returns for 1882 is 6·6 per cent.; in the provincial returns, 4·5. Of the registered births of the eleven years 1872–82, the proportion not finally accounted for in regard to vaccination in each year respectively has been as follows:—

	Metropolis.	Rest of England.
1872	8·8	4·5
1873	8·7	4·2
1874	8·8	4·1
1875	9·3	3·8
1876	6·5	4·0

Digest of Vaccination Officers' Returns.

	Metropolis.	Rest of England.
1877	7·1	4·1
1878	7·1	4·3
1879	7·8	4·5
1880	7·0	4·5
1881	5·7	4·3
1882	6·6	4·5

		Metropolis.	Rest of England.
Average of 5 years	1873–77	8·1	4·1
„ „	1878–82	6·8	4·4

In 1882, the proportion of cases unaccounted for, after deduction of the postponed cases, in the metropolis and in the rest of the kingdom, was 5·9 and 3·6 per cent. respectively.

[The detailed returns concerning different Unions, and some other matter (Appendices 2 and 3), not of general interest, are omitted.]

No. 4.

Reprint from Medical Officer's Report for 1881.

REPRINT from MEDICAL OFFICER'S REPORT for 1881, being COMMENTS on a PAPER by DR. STEVENS on SMALL-POX MORTALITY in LONDON in that Year.

SMALL-POX IN LONDON IN 1881.

Small-pox in London; Incidence on vaccinated and unvaccinated.

In June 1881, on the occasion of a twelvemonth having passed since the Registrar-General began to record what he could learn about vaccination in the case of deaths registered in London from small-pox, I had the honour to submit to you a memorandum on the relative mortality from small-pox in the vaccinated and in the unvaccinated inhabitants of London.

This memorandum was presented by you to Parliament and extracts from it are reproduced in appendix to the present report.* Its principal facts were summed up as follows :—

COMPARATIVE SMALL-POX DEATH-RATES among LONDONERS VACCINATED and UNVACCINATED respectively, for the 52 weeks ended 29th May 1881.

Death-rate of People of subjoined Ages.	Per Million of each Age of the Vaccinated Class.	Per Million of each Age of the Unvaccinated Class.
All ages - - - - - -	90	3,350
Under 20 years - - - - -	61	4,520
Under 5 years - - - - -	40½	5,950

It was beyond the scope of the memorandum to record the completeness or incompleteness of the vaccination in the case of those recorded as dying after vaccination. The above summary figures related to "vaccination" in the aggregate. The power of a thorough vaccination to protect against death from small-pox is at least ten times greater than the power of much that passes under the name of vaccination, but the paper was not concerned with this difference.

Dr. Stevens's inquiries.

The Board, however, had another interest in observing a mortality from small-pox, whatever might be its degree, among the vaccinated. It was important to learn how far such mortality might be attributable to any faults within the system of public vaccination which the Board is charged to administer. Accordingly, at my request, Dr. Stevens undertook, during the year 1881, an examination of all the small-pox deaths occurring in the houses and hospitals of London, with inquiry (in which he was aided by the vaccination officers) as to all the deaths among people alleged to have been vaccinated or whose vaccination was doubtful; and with more detailed personal inquiry into the cases of people who were said to have been vaccinated by public vaccinators during the working of the Vaccination Acts of 1867 and 1871.

Small-pox mortality statistics

Dr. Stevens has given me a number of tabular statements and notes concerning the small-pox mortality of the year 1881. The total number of deaths is given by him at 2,379; it is recorded at 2,371 by the Registrar-General during the 52 weeks of the year. These numbers

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* Not here reproduced.

Reprint from Medical Officer's Report for 1881.

include 31 deaths in persons brought into London hospitals from beyond the metropolis. Of the 2,348 deaths of Londoners, 1,526 occurred in hospitals, 822 in the homes of the patients ; being 65 and 35 per cent. respectively. Of the gross 2,379 persons who died, 678 were taken ill while resident in the union or parish in which they were born ; the remaining 1,701 were not so resident at the time of their attack. There is a good deal of importance attaching to the mobility thus indicated of the population, especially as it affects children ; but upon this I do not at present insist.

Out of the 2,379 deaths, children under fifteen numbered 1,125, or not quite half the total number ; children under ten numbered 953 ; under five, 667.

Relative incidence on children less than formerly.

Formerly, in the 20 years before 1871, when public vaccination was gratuitously provided, but when compulsion was little more than nominal, more than half the deaths from small-pox that occurred in London were of children under their fifth year. In the ten years, 1851–60, these children contributed 59·5 per cent. to the all-age small-pox mortality of the metropolis, and in 1861–70 they contributed 54·3 per cent. In the year 1881 (when, I repeat, not quite half the deaths were contributed by children under 15), children under five contributed only 27·8 deaths to every 100 deaths from small-pox in the metropolis. These figures will show that it is especially to the advantage of children that vaccination has been made compulsory. For in the year 1881, the unvaccinated suffered from small-pox (as the above-quoted table will have shown) immensely in excess of the vaccinated ; the difference between the two classes, observable at every age, being most observable at younger ages.

Small-pox mortality among children under 10:

Taking now with Dr. Stevens the calendar year 1881, and examining for the metropolis the mortality from small-pox, I propose to restrict my own observations to the experience he brings about children under 10 years of age. I do so on this occasion for two reasons : as I wish to take account of the more active enforcement of vaccination that began ten years ago ; and as I am not proposing now to discuss any question of waning influence of vaccination, or need of re-vaccination.

The population of London under ten was 916,784 on census night 1881. It divides, to speak in round numbers, into about 55,000 unvaccinated and 861,000 vaccinated.*

in vaccinated compared with unvaccinated ;

In 1881 the small-pox deaths of London among children under ten turn out to have been : (*a*) 782 deaths among the 55,000 who had not been vaccinated ; (*b*) 125 deaths among the 861,000 who had been vaccinated. Upon equal numbers of the two classes, therefore, the mortality from small-pox among the unvaccinated was about a hundred-

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* For the grounds on which this numerical division of the population is made, I refer to the text of the above-quoted memorandum. The estimate of the number of unvaccinated is probably too high, making the rate of death among the unvaccinated lower than the truth. But I am anxious to avoid any appearance of exaggerating their death-rate.

Dr. Stevens, " in fairness to the vaccination officers," directs attention to the fact that of the deaths among the unvaccinated there were 126 among children of three months of age and under,—a time of their lives when many of them might indeed have been vaccinated, but when they were not old enough to come within the sphere of the vaccination officer's duty.

The fact of vaccination or no vaccination was learned in the case of two or three hundred of the deaths under 10, not from death registers but from house inquiry made by the vaccination officers. In the case of 46 small-pox deaths, however, the fact could not be learned at all ; and the above figures, 782 and 125, together fall short of the total 953 by this number 46.

Reprint from Medical Officer's Report for 1881.

fold the mortality from small-pox among the vaccinated. This degree of protection was given to children under ten by the average current vaccination of London.

in the publicly compared with the privately vaccinated.

London vaccination, however, has to be considered as being of divers sorts; and Dr. Stevens's inquiries have taken account of these. The 125 children under ten who died of small-pox after an alleged vaccination, have to be reduced to 117 by deduction of those who were discovered on his personal inquiry not to have been vaccinated at all, or to have been "unsuccessfully" vaccinated; and this number 117 divides into 82 vaccinated by private practitioners, and 35 vaccinated by public vaccinators. Now the number of vaccinated children under ten in London is made up in about equal numbers of those vaccinated by private practitioners, and of those vaccinated at the public expense. Among the privately vaccinated there were 82 deaths, among the publicly vaccinated there were but 35.*

A cause of inefficiency in private vaccination.

From these figures we may deduce the fact, creditable to public vaccination in London, that it protects against small-pox much more than private vaccination. The difference between the two, however, deserves a little more consideration. Children privately vaccinated comprise most of the children of the upper classes, who certainly run less risk of small-pox infection than the poor. The comparatively large mortality among those privately vaccinated therefore becomes the more striking. Some of such children are doubtless vaccinated efficiently enough, and are protected from small-pox as completely as any of those vaccinated at public stations. But we who have much to do with the total vaccination of London know of a particular source of inefficiency in private vaccination, of a sort to be responsible for a relatively high mortality from small-pox. It consists in a form of private vaccination that offers itself in competition with public vaccination, and which parades its inefficiency as a reason for its acceptance by ignorant people. Its professors say to young mothers, "Do you come "to me, and I won't hurt your baby; I'll make only one place on its "arm, not four, as those public vaccinators do." And undoubtedly there are medical men to be found who, having formed some opinion of their own about the sufficiency of one vesicle, cannot be induced to set aside that opinion in deference to the indisputable evidence to the contrary that every small-pox hospital holds up to them.

Protection to children by public vaccination.

Dr. Stevens goes on to examine the 35 cases where death from small-pox is reported to have occurred among children under ten years of age vaccinated by public vaccinators. It turned out upon inquiry that 12 of these 35 had never been vaccinated until after they had been exposed to small-pox infection, when it was too late to protect them against catching the disease, and too late to modify its virulence. There remained 23 instances, and only 23, in which the question arose, "Why "did public vaccination fail to protect from death by small-pox during "the first 10 years of life?" Dr. Stevens's notes enable a reply to be given to this question in the case of a good many of the children, and they are worth consulting, as showing to what small dimensions the

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* Deduced from the returns of public vaccination, the number of London children under ten vaccinated at the public expense would appear to be greater (in the proportion of 53 to 47) than that of children privately vaccinated. But as we are considering the whole vaccinated community up to the age of ten, and the children gratuitously vaccinated, being mostly poor, have doubtless not survived up to their tenth year in the same proportion as the children of those who pay for vaccination, it has been thought well to regard the vaccinated population under ten as being made up of equal numbers of publicly and privately vaccinated.

Reprint from Medical Officer's Report for 1881.

failure of public vaccination has dwindled. The record of small-pox deaths among children under ten vaccinated by public vaccinators now proves to be made up (*a*) of two cases that could not be traced, and, in almost equal numbers, by (*b*) cases where the child was ill of some independent disease before the occurrence of what was registered as small-pox (in a few it is doubtful whether small-pox was present at all), and (*c*) cases carrying scanty and imperfect marks on their arms though done by the public vaccinator. There was one child, and only one, of whom it could be said that vaccination had apparently been performed in the manner contemplated by the Board's instructions, and yet had died of small-pox contracted while it was in its usual health. That there should be a stray case of the last kind is no wonder; such cases find their parallel in those occasional instances where small-pox itself attacks a person, even severely, and yet leaves him liable to death from a second attack of the same disease after a few years' interval.

We may ascribe, therefore, a part of the 35 deaths, but only a small part of this very small number, to unsatisfactory quality of vaccination, as done in some instances by public vaccinators. But, the very great bulk of the vaccinations performed by public vaccinators have been protective against death by small-pox during the recent epidemic, and the creditable account which Dr. Stevens brings from inspection of their actual work is endorsed by the evidence of the death returns.

Saving of children from death by small-pox:

I would once again state explicitly, for general information, the extent to which London children have profited by vaccination, as they received the operation from the aggregate of medical practitioners during the recent epidemic. I shall continue, for the reasons I have already given, to speak only of children under ten, and be content to ignore all question of advantage given by vaccination to persons of later age.

It has already been said that in 1881, among the 55,000 children who had not been vaccinated, there were 782 deaths from small-pox; among the 861,000 children who had been vaccinated, that there were 125 deaths from small-pox.

If the London children under ten who were unvaccinated had had the protection which the current vaccination gives, not 782 of them, but at the outside *nine*, would have died of small-pox during the year.

If the 861,000 vaccinated children had died at the rate of the 55,000 unvaccinated, we should not now be considering 125 small-pox deaths and how they can be reduced, but we should be confronted with an additional 12,000 and more deaths from small-pox, occurring during the year in the London population under ten years of age.

can only have been due to vaccination,

This saving of life was essentially the effect of vaccination. If anyone should advance the opinion that the vaccinated may have owed their escape from death by small-pox, not to their vaccination, but to their belonging to that richer class of the community which, through being better lodged and guarded, is less exposed to the infection of small-pox, the reply is at hand. Let us consider separately the class of the population which has its children vaccinated at the public expense. We know that it is not less than half the population, and that almost the whole of the poorer population is included in this class. No one will say that this half is the better housed, or its children more out of the way of infection, or that its children can command better aids to recovery, if they should be attacked.

The children under ten living in London, and having been vaccinated at the public expense, number about 430,000. If the rate of death which prevailed among the unvaccinated children of London had prevailed also among this section of the vaccinated, then, among these

Reprint from Medical Officer's Report for 1881.

vaccinated children there would have been more than 6,000 deaths from small-pox last year. But out of these children, being in chief part children of poorer class, what was the number of deaths that actually did occur from small-pox? Not 6,000, nor 1,000, but at the outside 35; more truly 23, for 12 of them were not vaccinated till small-pox had actually taken hold on their bodies.

In spite, therefore, of any greater exposure to small-pox undergone by the poorer half of the vaccinated community, it is seen that the poorer half had actually less mortality from small-pox among its children than the richer half; and the opinion that the escape of the vaccinated from death by small-pox was due to any smaller risk of small-pox infection encountered by the vaccinated as compared with the unvaccinated may be confidently set aside.

and largely to the operation of vaccination law.

The saving of life which I am now recording is a saving of 12,000 lives by vaccination to children under ten years of age in London in 1881. It is not to be disputed that this saving by vaccination is in great measure due to the operation of the Vaccination Acts of 1867 and 1871. The same operation of these Acts is manifested in the before-mentioned change in the age of people who die from small-pox in London. In the two periods of ten years immediately preceding 1871, 59 and 54 per cent., more than half, of the total small-pox mortality was borne by children under five years old; now only 28 per cent., little more than a quarter, of the total small-pox mortality, falls upon such children.

No. 5.

STATEMENT from the YEARLY BILLS of MORTALITY delivered in by DR. LETTSOM to a COMMITTEE of the HOUSE of COMMONS in 1802.

Yearly Bills of Mortality.

Years.	Total No. of Burials.	Total No. of Small-pox in all.	In 1,000.	Years.	Total No. of Burials.	Total No. of Small-pox in all.	In 1,000.
1667	15,842	1,196	75	1731	25,262	2,640	104
1668	17,278	1,987	115	1732	23,358	1,197	51
1669	19,432	951	49	1733	29,233	1,370	46
				1734	26,062	2,688	103
1670	20,198	1,465	73	1735	23,538	1,594	67
1671	15,729	696	44	1736	27,581	3,014	100
1672	18,230	1,116	61	1737	28,823	2,084	74
1673	17,504	853	49	1738	25,825	1,590	61
1674	21,201	2,507	118	1739	25,432	1,690	66
1675	17,244	997	58				
1676	18,732	359	19	1740	30,811	2,725	88
1677	19,067	1,678	88	1741	32,169	1,977	61
1678	20,678	1,798	87	1742	27,483	1,429	52
1679	21,730	1,967	91	1743	25,200	2,029	80
				1744	20,606	1,633	79
1680	21,053	689	33	1745	21,296	1,206	56
1681	23,971	2,982	125	1746	28,157	3,230	114
1682	20,691	1,408	68	1747	25,494	1,380	54
1683	20,587	2,096	102	1748	23,869	1,789	75
1684	23,202	156	7	1749	25,516	2,625	102
1685	23,222	2,496	107				
1686*	22,609	1,062	47	1750	23,727	1,229	51
				1751	21,028	998	47
1701	20,471	1,095	53	1752	20,485	3,538	172
1702	19,481	311	16	1753	19,276	774	40
1703	20,720	898	43	1754	22,696	2,359	103
1704	22,684	1,501	66	1755	21,917	1,988	90
1705	22,097	1,095	50	1756	20,872	1,608	77
1706	19,847	721	36	1757	21,313	3,296	154
1707	21,600	1,078	50	1758	17,576	1,273	72
1708	21,291	1,687	79	1759	19,604	2,596	132
1709	21,800	1,024	47				
				1760	19,830	2,187	110
1710	24,620	3,138	127	1761	21,063	1,525	72
1711	19,833	915	46	1762	26,326	2,743	104
1712	21,198	1,943	22	1763	26,143	3,583	137
1713	21,057	1,614	77	1764	23,202	2,382	102
1714	26,569	2,810	106	1765	23,230	2,498	107
1715	22,232	1,057	48	1766	23,911	2,334	97
1716	24,436	2,427	99	1767	22,612	2,188	96
1717	23,446	2,211	94	1768	23,639	3,028	128
1718	26,523	1,884	71	1769	21,847	1,968	90
1719	28,347	3,229	114				
				1770	22,434	1,986	88
1720	25,454	1,440	57	1771	21,780	1,660	76
1721	26,142	2,375	91	1772	26,053	3,992	153
1722	25,750	2,167	84				
General Average	903,789	65,079	72	General Average	1,005,279	89,628	89

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* The reason why the 14 years from 1686 to 1701 are omitted, is because in the bills the amounts of the small-pox and measles are not distinguished. No reason is given for omitting the figures of the years 1723–30.

Yearly Bills of Mortality.

FURTHER STATEMENT from the YEARLY BILLS of MORTALITY, examined for the purposes of this Report.

Years.	Deaths reported in the Bills of Mortality.	Deaths ascribed to Small-pox.	Small-pox Deaths to 1,000 reported Deaths from all Causes.
1773	21,656	1,039	48
1774	20,884	2,479	119
1775	20,514	2,669	130
1776	19,048	1,728	91
1777	23,334	2,567	110
1778	20,399	1,425	70
1779	20,420	2,493	122
1780	20,517	871	42
1781	20,709	3,500	169
1782	17,918	636	35
1783	19,029	1,550	81
1784	17,828	1,759	98
1785	18,919	1,999	105
1786	20,454	1,210	59
1787	19,349	2,418	125
1788	19,697	1,101	56
1789	20,749	2,077	100
1790	18,038	1,617	89
1791	18,760	1,747	93
1792	20,213	1,568	77
1793	21,749	2,382	109
1794	19,241	1,913	99
1795	21,179	1,040	49
1796	19,288	3,548	184
1797	17,014	522	30
1798	18,155	2,237	123
1799	18,134	1,111	61
1800	23,068	2,409	104
1801	19,374	1,461	75
1802	19,379	1,579	81
1803	19,582	1,202	61
1804	17,038	622	36
1805	17,565	1,685	96
1806	17,938	1,158	64
1807	18,334	1,297	71
1808	19,954	1,169	58
1809	16,680	1,163	70
1810	19,893	1,198	60
1811	17,043	751	44
1812	18,295	1,287	70
1813	17,322	898	52
1814	19,283	638	33
1815	19,560	725	37
1816	20,316	653	32
1817	19,968	1,051	52
1818	19,705	421	21
1819	19,228	712	37
1820	19,348	792	41
1821	18,451	508	27
1822	18,865	604	32
1823	20,587	774	37
1824	20,237	725	36
1825	21,026	1,299	62
1826	20,758	503	24
1827	22,292	616	27
1828	21,709	598	27
1829	23,524	736	31
1830	21,645	627	29
1831	25,337	563	22

[NOTE.—From the year 1831 until the commencement of Registration of Births and Deaths in 1837, the further figures are not obtainable from the London Bills of Mortality, so that this table cannot be completed.]

Dividing the above years, 1773–1831, into two groups, namely, 1773–1801 (29 years) and 1802–31 (30 years), and repeating the "general average" of Dr. Lettsom's Table, we have as follows:—

Group of Years.	Total Burials.	Total Small-pox.	In 1,000.
1773-1801	575,637	53,076	92
1802-31	590,862	26,554	45

YEARLY MORTALITY from all CAUSES and from SMALL-POX in the METROPOLIS of the REGISTRAR-GENERAL since the COMMENCEMENT of CIVIL REGISTRATION in 1837, with RATIO of SMALL-POX per 1,000 of TOTAL DEATHS—shown on the PLAN of the foregoing TABLES:—

Yearly Bills of Mortality.

Years.	Deaths from all Causes.	Deaths by Small-pox.	Small-pox per 1,000 Deaths from all Causes.	Death-rate during successive Years from Small-pox per 1,000 Persons living.	
				Years.	Death-rate.
1838	52,698	3,817	72	1838	2·16
1839	45,441	634	13	1839	0·35
1840	46,281	1,235	27	1840	0·67
1841	45,284	1,053	23	1841	0·56
1842	45,272	360	8	1842	0·19
1843	48,574	438	9	1843	0·22
1844	50,423	1,804	36	1844	0·89
1845	48,332	909	19	1845	0·44
1846	49,089	257	5	1846	0·12
1847	60,442	955	16	1847	0·43
1848	57,628	1,620	28	1848	0·72
1849	68,432	521	7	1849	0·23
1850	48,579	499	10	1850	0·21
1851	55,354	1,062	19	1851	0·45
1852	54,213	1,159	21	1852	0·48
1853	61,202	211	3	1853	0·09
1854	73,697	694	9	1854	0·28
1855	61,506	1,039	17	1855	0·41
1856	56,786	531	9	1856	0·20
1857	60,150	156	2	1857	0·06
1858	63,882	242	4	1858	0·09
1859	61,617	1,158	19	1859	0·42
1860	61,821	898	14	1860	0·32
1861	65,001	217	3	1861	0·08
1862	66,950	366	5	1862	0·13
1863	72,346	1,996	28	1863	0·69
1864	77,723	547	7	1864	0·19
1865	73,460	640	9	1865	0·21
1866	80,129	1,391	18	1866	0·46
1867	70,588	1,345	19	1867	0·44
1868	74,908	597	8	1868	0·19
1869	77,933	275	4	1869	0·09
1870	77,278	973	12	1870	0·30
1871	80,332	7,912	98	1871	2·42
1872	70,893	1,786	25	1872	0·54
1873	76,634	113	1½	1873	0·03
1874	76,606	57	0¾	1874	0·02
1875	81,513	46	0½	1875	0·01
1876	77,411	736	9	1876	0·21
1877	77,002	2,551	33	1877	0·71
1878	83,695	1,417	16	1878	0·39
1879	85,540	450	5	1879	0·12
1880	81,128	471	6	1880	0·12
1881	81,071	2,367	29	1881	0·62
1882	82,905	430	5	1882	0·11
1883	80,578	136	2	1883	0·03
1884	83,050	1,251	15	1884	0·30

No. 6.

EXTRACT from the 43rd ANNUAL REPORT of the REGISTRAR-GENERAL (1880), pages xxi.—xxvi.

In discussions concerning the protective influence of vaccination, too exclusive attention is usually given to the change that has occurred since its introduction in the death-rate from small-pox *at all ages*. It is important that not only this, but also the changes in the death-rate *at successive periods of life*, should be taken into account. Unfortunately the causes of death were not abstracted in combination with ages until the year 1847. Our inquiry must therefore be limited backwards by that date. In all this period of time vaccination has been in use, and some or other public provision has existed for its gratuitous performance; so that there are no means of comparing with any precision the small-pox rates at different age-periods before and after the introduction of vaccination. But the extent to which vaccination has been used by the public, and the nature of the state provision to insure its performance, have differed considerably at different times within the period; so that it is possible to compare sub-periods of years in which vaccination was more universal with sub-periods in which it was less so.

The series of years, 1847–1880, when looked at from this point of view, divides itself naturally into three sub-periods; the first is from 1847 to 1853, inclusively, in which, though gratuitous vaccination was offered to the public by the state, recourse to it was purely optional. The second sub-period begins with 1854, when vaccination became obligatory, but without any effectual means of enforcing the obligation being instituted, and closes with 1871. Then commences the third and present sub-period, during which the obligation on the part of parents to have their children vaccinated has been more rigidly enforced, owing to the compulsory appointment of vaccination officers by the Boards of Guardians.

Taking, then, these three sub-periods and calculating the death-rates from small-pox in each of them at successive life-periods, we have the following results :—

TABLE L.—MEAN ANNUAL DEATHS from SMALL-POX at successive life-periods, per million living at each such life-period.

SUB-PERIOD.	Age.						
	All Ages.	0–	5–	10–	15–	25–	45– and upwards.
(1.) Vaccination optional (1847–53).	305	1,617	337	94	109	66	22
(2.) Vaccination obligatory, but not efficiently enforced (1854–71).	22	817	243	88	163	131	52
(3.) Vaccination obligatory, and more efficiently enforced by Vaccination Officers. (1872–80).	156	323	186	98	173	141	58
Entire period of obligatory vaccination (1854–80) -	198	633	222	92	167	135	55

These figures show conclusively that, coincidently with the gradual extension of the practice of vaccination, there has been, in the first place, a gradual and notable decline in the mortality from small-pox at all ages; in the second place, that this decline has been exclusively among persons under ten years of age, and most of all among children under five, in which group the rate fell no less than 80 per cent. in the interval between the first and the third sub-period; and, thirdly, that after the age of ten years the mortality, so far from having declined, has actually increased; very slightly among persons of from 10 to 15 years of age, but very greatly for persons older than this; and, lastly, that the increase has been the greater the more advanced the time of life. Thus, again comparing the third with the first sub-period, the rate for persons from 15 to 25 years of age rose 59 per cent.; from 25 to 45 years it rose 114 per cent.; and after 45 its rise was no less than 164 per cent.

These striking changes in the rates at successive periods of life are, it will be noted, not petty differences, nor mere matters of decimal points or the like, but enormous changes, of such magnitude as utterly to preclude all explanations which would refer them to chance fluctuations or to errors in registration. How, then, are they to be explained?

Some persons, who are opposed to vaccination, have attempted to account for the decline in small-pox mortality, by referring it, not to vaccination, but to the general improvement that has been effected in the sanitary conditions of life. It is evident that such explanation will not account for the striking changes disclosed in Table L, unless it can be shown, that similar changes, corresponding in respect of direction, of extent, and of the life-periods at which they occurred have manifested themselves in the general death-rate, or, more precisely, in the death-rate from all other causes than small-pox. For no one can possibly suppose that the general improvement in sanitary conditions can have had exclusive influence in the reduction of small-pox, and left the other causes of mortality unaffected. Let us, therefore, see whether any such corresponding changes have really occurred in the general death-rate. In the following table the rates in the first sub-period, 1847–53, are compared with the rates in the third sub-period, 1872–80, the former being the sub-period in which vaccination was optional, and the latter the sub-period in which it was not only compulsory but enforced with some efficiency. The table is constructed in the following manner. Each death-rate in the first sub-period is taken as 100, and the figures in the table give the death-rates in the third sub-period as compared with that 100; in the first line for small-pox, and in the other line for all other diseases together excepting small-pox.

TABLE M.—DEATH-RATES in 1872–80 compared with those in 1847–53, the latter taken as 100.*

—	ALL AGES.	0–	5–	10–	15–	25–	45–
Small-pox - -	51	20	55	104	159	214	264
All other causes -	93	94	70	67	71	88	97

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* If we contrast the sub-period of optional vaccination (1847–53) with the entire period of obligatory vaccination (1854–80) we have figures that are not quite so strongly contrasted as those in Table M., but which lead to the same conclusions.

Death-rates in 1854–80, compared with those in 1874–53, the latter taken as 100.

—	ALL AGES.	0–	5–	10–	15–	25–	45–
Small-pox - -	65	39	66	98	153	204	249
All other causes -	96	99	82	78	81	92	96

It is plain that the correspondence required by the hypothesis does not exist. At each age-period after the tenth year the changes in the rates were in contrary directions; the small-pox rate increased, while the rate from other causes declined. In the two age-periods under ten years, the changes were in the same direction, but utterly disproportionate to each other in amount. Especially was this the case in the first age-period, for while the death-rate from other causes at this age fell only 6 per cent., the death-rate from small-pox fell no less than 80 per cent. The most, therefore, that can possibly be claimed at this period of life as the effect of general sanitation, in respect of small-pox mortality, is that it contributed to its reduction in a small fractional degree. In the next age-period, from 5 years to 10, the discrepancy, though still large, is not so great; the death-rate from small-pox fell 45 per cent., while the death-rate from other diseases fell 30 per cent. At this period of life, therefore, a sensible share in the reduction of the small-pox mortality might fairly be ascribed to improved sanitation. Taking the deaths at all ages, one-seventh part, and one-seventh part only, of the reduction in small-pox mortality may be claimed as possibly resulting from other causes than vaccination; for, while the death-rate from other causes fell 7 per cent., the death-rate from small-pox fell 49 per cent.

The hypothesis, then, that would explain the great fall in small-pox mortality, by referring it, not to vaccination, but to general sanitary progress, must be rejected as utterly untenable. There can be no rational doubt but that the death-rate from this disease fell not only coincidently with, but in consequence of, the extended use of vaccination. The difficulty is to explain why this fall was not common to all periods of life; why the rate of mortality fell among young persons but rose, and this very greatly, among those of more advanced age, and the more so the later the period of life. Doubtless at first sight this progressive rise in the small-pox rates at the later life-periods seems incompatible with the asserted protective influence of vaccination; but on further consideration it will be seen that this is not the case, and indeed that such rise is what might naturally be anticipated from what is known as to the character and degree of the immunity conferred by vaccination. For it is pretty generally* recognised, and this on good grounds, that the immunity derived from vaccination is both less perfect and less permanent than that conferred by small-pox itself; its efficacy diminishing with the lapse of time, while the protective influence of small-pox remains practically unaltered. If we admit the existence of this difference between the two forms of immunity, we have the following explanation of the fall of the rate in early life and its rise at the later ages.

Before vaccination came into use, few persons escaped having small-pox at some or other time in their lives. The great majority had it when young, and of these a large proportion died, causing a very high death-rate in the earlier age-periods. But those who survived the attack enjoyed a practically complete immunity for the rest of their lives, and, as they formed a considerable proportion of the population at the later age-periods, the small-pox death-rates at these later periods of life were very low. But when vaccination came into use, and in proportion as its use became more and more general, the relative conditions of the different age-periods as regards immunity were materially altered, and partially inverted. Childhood, previously altogether unprotected, now received a very considerable immunity; while the later ages, previously much protected, now had their immunity considerably diminished, and the more so, the later the period of life and the more remote therefore the date of vaccination.

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* It appears that this difference is not universally admitted. The best authorities however accept it. See, for instance, Curschman in Ziemssen's Cycl., ii., 406; Trousseau, Clin. i., 118, 120, 129; and Marson in Reynold's Syst. of Med., i., 452, 469. Mr. Marson found that in a period of 16 years, dating from a time when the number of persons protected by previous small-pox, natural or inoculated, was probably about equal to the number protected by vaccination, there were in the Small-pox Hospital 3,094 cases of small-pox after vaccination, but only 47 cases of small-pox after small-pox, and even of these 47 cases "some would perhaps admit of doubt."

The progressive weakening in the individual of the protective influence of vaccination would appear to begin at a very early date; for while the death-rate in the first five years of life fell 80 per cent., the rate in the next quinquennium fell only 45 per cent. The whole of this difference in the declines must not, however, be attributed to a weakened influence of vaccination: for the decline of 80 per cent. in the first quinquennium of life was doubtless not merely due to an increased use of vaccination, but also to its earlier performance; for under the Compulsory Acts infants are vaccinated much earlier than formerly was the case, being vaccinated in the first three months of life, whereas the previous rule had been not to vaccinate them until more than a year old.

The explanation suggested above is open to one obvious criticism. The persons who in 1872–80, and *a fortiori* the persons who in 1854–71, were aged 45 years and upwards, were all born before any compulsory enactments came into force; and, as these compulsory enactments apply only to infants, such older persons, it may be urged, cannot possibly have been affected by the changes in the vaccination laws, and yet it is in this group that the death-rate from small-pox has risen most notably.

Doubtless this criticism is just, so far as any direct action of the law is concerned. No person who, in 1872–80 or even in 1854–71, had reached the age of 45, had been vaccinated under the compulsory clauses. But it must be remembered that the successive changes and increasing stringencies in the Vaccination Acts were themselves but the outcome of more thorough recognition on the part of the public of the utility of vaccination; and it cannot reasonably be doubted that the same advance in knowledge, which led to the compulsory enactments for the protection of infants, must also have induced a constantly increasing number of persons to submit themselves and their children, though outside the age-limit of the compulsory clauses, to voluntary vaccination. There would thus be brought about a gradual increase, even at the later periods of life, in the proportion borne by the vaccinated to the unvaccinated, and a concomitant decrease in the proportion of those who had already had small-pox, and who therefore enjoyed the most perfect form of protection.

If this answer to the criticism be deemed insufficient, there remains but one possible explanation of the increased death-rates from small-pox at the later ages of life. If the groups of persons over 45 years of age in the three successive sub-periods in Table L were on a par with each other in the matter of protection by vaccination, and yet died of small-pox in constantly increasing proportions, as was indisputably the case, it can only have been because small-pox itself was becoming more and more virulent in character; for, the protection remaining unchanged, the death-rate constantly increased. If this be so, then it is plain that the saving of life due to vaccination has been even greater than hitherto supposed. For not only did the small-pox death-rate fall with its extended use from 305 per million living to 156, but it so fell in spite of an increased intensity of the virus, which would, if unimpeded, have enormously increased the mortality.

Not impossibly, the increased small-pox rates at the later age-periods may be due to a combination of the suggested causes, and be attributable partly to a diminished amount of protection possessed by the older people and partly to an increased virulence of the disease. And as regards the supposed increased virulence, the existence of which it may be noted is suspected on other strong grounds, it is perhaps worth consideration, as at any rate a matter of interesting speculation, whether such increase might not have been anticipated as a natural result of the extended use of vaccination. For the numerous analogies that exist between contagia and living organisms render it not impossible, that just as the repeated and long-continued weeding out of those individuals in a species who are least able to escape from their enemies leads to a constantly increasing adaptation in the species for escape, so also may vaccination, by continuous weeding out of the less resistant varieties of small-pox, leave only its more virulent, and therefore less easily eliminated, forms to survive.

Before leaving the subject of small-pox it may be well, considering the importance of the matter, to demonstrate the great shifting produced by vaccination in the age-incidence of its mortality by another method. The shifting is shown very simply and very strikingly by the following comparative figures, which are based on the records of the seven years (1872–4 and 1877–80) in which alone vaccinated and unvaccinated deaths were abstracted separately.

TABLE N.—PROPORTION of DEATHS under and over 15 years of Age, per 1,000 deaths from SMALL-POX in VACCINATED and UNVACCINATED persons respectively.

Age.	Unvaccinated.	Vaccinated.
Under 15 - -	672	334
Over 15 - -	328	666
	1,000	1,000

The figures are almost exactly inverted in the two columns. It will be noted that in this table all question as to the reduction of small-pox mortality by vaccination is set aside. The only matter considered is the age-incidence; and it is for those who uphold the strange doctrine, that vaccination is utterly without influence on small-pox, to explain, how this inversion of incidence can possibly be explained, if their doctrine be true.

If the interpretation given to the figures in the preceding table be correct, the practical lesson to be drawn from them is obvious. Those persons who would avoid or lessen their risk of small-pox in the later stages of life, must give themselves and their adult offspring the same protection which is found so efficacious in childhood. They must, that is to say, be re-vaccinated.

No. 7.

On Prevalence of Small-pox in Kilmarnock in the last Century; by Dr. John C. M'Vail.

EXTRACTS from an INQUIRY into the PREVALENCE of SMALL-POX in KILMARNOCK in the last Century. By JOHN C. M'VAIL, M.D., Kilmarnock.*

[*Read before the Philosophical Society of Glasgow, 1st February* 1882, *and here reprinted by permission of the Author.*]

In the beginning of the year 1728, the schoolmaster of Kilmarnock, who seems to have been a man considerably in advance of his time, determined to keep a register of mortality for his parish, and the result of his decision is a beautifully-written old volume, which begins as follows:—

> "Mr. Patrick Paisley, and Mr. Lawrence Hill, Ministers, March,
> " 1728. This register is begun by Mr. Robert Montgomerie, School-
> " master in Kilmarnock, and Session-Clerk. He having begun one of
> " the same kind before, anno 1705, which was carried on for some
> " yeirs and afterwards Lost when it was committed to another hand to
> " keep.
>
> " RO. MONTGOMERIE."

Besides giving the total annual births, the register consists of a statement of the date, name and designation, age, and cause of death, of all who died in the parish of Kilmarnock, from March 1st, 1728, to March 1st, 1764. Why it ends so abruptly after these 36 years we do not know. * * * * * *

The records of these 36 years are in every respect interesting, and in some points important. The population of Kilmarnock in 1763 is said to have been nearly 5,000. During the following 29 years it increased at the rate of about 64 per annum.† Supposing that during the period under consideration the annual increase were 45, the average population of the 36 years would not be more than 4,200. The average number of births per annum was 134. Now, the number of births since 1855 (the date of introduction of registration) [in Scotland] has been 40 per annum to each 1,000 of the population. Calculated by this standard, the mean population in the 36 years would be 3,350. I will take 4,200, however, as being the correct number, so as to avoid the possibility of exaggerating the mortality from small-pox.

The total deaths in the period in question were 3,860, or at the rate of 24·36 per 1,000 per annum—fully 1 per 1,000 per annum above the average of the past 25 years. If the population were only 3,350, the death-rate would be 32 per 1,000 per annum.

The causes of death are shown in Table I., in which I have adopted the orthography of the old session-clerk.

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* For much valuable aid in various matters connected with the preparation of this paper I am indebted to Mr. James Rose, Registrar of Kilmarnock.

† M'Kay's History of Kilmarnock, 4th edition, footnote to p. 342.

TABLE I.

MORTALITY TABLE, 1728–1764, in groups of SIX YEARS.

DISEASE.	1728-34.	1734-40.	1740-46.	1746-52.	1752-58.	1758-64.	TOTAL.
Decay - - -	190	159	135	132	141	158	915
Age - - -	88	95	91	97	131	123	625
Small-pox - - -	111	67	139	95	133	76	622
Fever - - -	99	80	96	88	95	87	545
Bowel-hive - -	33	46	35	48	49	63	274
Kinkhost or Cinkough	14	47	1	12	11	31	116
Closing - - -	—	5	29	30	33	9	106
Measles - - -	1	11	18	52	4	7	93
Flux - - - -	11	17	53	6	1	7	95
Childbed - - -	11	4	4	10	16	14	59
Teething - - -	12	12	4	6	5	16	55
Suddenly and Hastily -	4	5	9	2	4	5	29
Consumption - -	2	—	—	3	—	20	25
Gravel - - -	8	5	3	3	2	1	22
Dropsie, Hydropsic, and Swelling - -	6	2	2	5	4	3	22
Palsie - - -	4	4	3	5	—	3	19
Colick - - -	8	1	1	3	4	2	19
Tympany - - -	2	2	4	2	6	1	17
Vomiting - - -	12	2	—	—	—	—	14
Pleurisy and Stiches -	1	2	1	1	5	2	12
King's Evil, Scrofula, and Cruels - -	5	—	3	—	—	2	10
Asthma - - -	2	4	2	1	--	1	10
Gout - - - -	1	5	4	—	—	—	10
Cancer - - -	2	1	1	1	1	1	7
6 each from stoping and Purging - - - - -							12
5 „ Fits and Convulsions, Accident, "Perished" -							15
3 „ Drowning, Lethargie, Scurvy, Rheumatism, and Rickets							15
Jaundice, Infancy, Apoplexy, Stone-cuting, Grief, Inflammation - - - - -							12
1 „ Broken Leg, Cholera, Cold, Ulcer, Overlaid, Mortification, Hystirick, Poison, Gangren, Spina Ventosa, Self-murder, Worm Fever, Universal Gout, Blabs, Ague, Weakness, Bowel-ricket - - -							17
Disease Unknown (about) -							68
Total - - -							3,860

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The flesh of Kilmarnock seems to have been heir to about 60 ills, and of these 4 are credited with fully two-thirds of the total deaths. At the head of the list is decay, with 915 deaths. What decay includes it is difficult to say. That senility was not a necessary element is shown by the fact that deaths at the ages of one and two years are attributed to it. The term probably embraces nearly all chronic diseases causing emaciation and debility—among which, of course, consumption is the chief. The second disease is age, which, with its 625 deaths, has formed a convenient class for nearly all who lived over 70 years, and for a large number between 60 and 70 years. Passing over small-pox in the meantime, fever is responsible for 545 deaths. The town then, as now, was built on low-lying ground, by the side of a stream so small as to be nearly dry in summer, and quite insufficient for carrying off the impurities for which it would be the receptacle. The term seems to include scarlet fever, as it is not mentioned elsewhere, and also, perhaps many cases of acute pneumonia, and other diseases running a rapid and febrile course. Bowel-hive is responsible for 273 deaths.

* * * * *

There can be no doubt but that small-pox caused more deaths, by a long way, than any other disease in old Kilmarnock. It is true that decay and age come before it in the list; but, as I have already pointed out, decay must include a great variety of diseases, and under the heading of age are placed, besides a number of deaths between the ages of 60 and 70, nearly all illnesses which proved fatal in those over 70 years—the old session-clerk evidently being a devout believer in the law which limits man's natural existence to three-score years and ten. Table II. may assist us in forming a mental picture as to the prevalence of small-pox in these old times. You will observe that epidemics occurred in 1728–9, 1733, 1736, 1740, 1744–5, 1749–50, 1754, 1757–8, and 1762—in all, nine epidemics in 36 years. In the intervals, the town was almost totally free from the disease. The average length of time between two epidemics was fully four years. They came with terrible regularity. If one or two were a little before their time, as in 1736 and 1740, the next were somewhat delayed, as in 1745 and 1750. The number of deaths varied from 45 to 95. You will notice that, on the whole, the extent of the epidemic corresponds—though not, of course, exactly—with the length of interval between the epidemics. Thus, the three largest (1754, 1749–50, and 1744–5) occurred after intervals of 4½ to 5 years; while previous to one of the mildest (1757–8) only 3 years and 2 months had elapsed. In 1733, however, there were only 45 deaths after a period of nearly 4½ years.

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Table II.

Deaths from Small-pox, 1728–1764.

Year.	Total Deaths.	Age in Years at Death.							Age not stated.
		Under 1.	1.	2.	3.	4.	5.	6 and Upwards.	
May 11th, 1728 to Feb. 29th, 1729	66	7	14	12	14	9	5	1 each aged 6, 11, 16, 22.	—
1730	—	—	—	—	—	—	—	—	1
1731	—	—	—	—	—	—	—	—	—
1732	—	—	—	—	—	—	—	—	—
Jan. 4th to Aug. 2nd - - 1733	45	12	9	13	6	4	—	1 aged 7	—
1734	—	—	—	—	—	—	—	—	—
1735	—	—	—	—	—	—	—	—	—
July 16th to Dec. 20th - - 1736	66	12	20	20	8	1	1	3 aged 6, 1 aged 10	—
1737	—	—	—	—	—	—	—	—	—
1738	—	—	—	—	—	—	—	—	—
1739	—	—	—	—	—	—	—	—	—
Feb. 25th to Aug. 3rd - - 1740	66	15	21	9	14	2	2	1 aged 6, 1 aged 8	1
1741	—	—	—	—	—	—	—	—	—
1742	—	—	—	—	—	—	—	—	—
1743	—	—	—	—	—	—	—	—	—
Aug. 6th, 1744 to May 17th, 1745	74	15	13	19	11	10	2	1 each aged 6, 7, 9	1
June 9th to Dec. 29th - - 1746	8	3	2	1	1	—	—	1 aged 6	—
1747	—	—	—	—	—	—	—	—	—
1748	2	—	—	1	1	—	—	—	—
Oct. 20th, 1749 to Mar. 15th, 1750	84	12	17	22	15	12	—	3 aged 6, 1 each aged 7 and 21.	1
1751	1	—	—	—	1	—	—	—	—
1752	—	—	—	—	—	—	—	—	—
1753	1	1	—	—	—	—	—	—	—
March 1st to Oct. 5th - - 1754	95	23	25	15	15	10	5	2 aged 7	—
1755	—	—	—	—	—	—	—	—	—
1756	—	—	—	—	—	—	—	—	—
March 15th, 1757 to Sept. 5th, 1758	46	11	10	13	6	4	1	—	2
1759	—	—	—	—	—	—	—	—	—
1760	—	—	—	—	—	—	—	—	—
1761	—	—	—	—	—	—	—	—	—
March 5th to Aug. 30th - - 1762	66	7	15	10	9	10	8	2 aged 6, 1 each aged 9 and 20.	3
1763	2	—	—	1	—	—	—	1 aged 26	—
Totals - -	622	118	146	136	101	62	23	27	9

The epidemic of 1728 began on May 11th by a death in Beansburn, a hamlet on the outskirts of the town, and near the castle of the old barons of Kilmarnock. The next was on June 25th, in the same family; and the virulence of the disease came to a crisis in November, when, in a total of 23 deaths for the month, 17 were due to small-pox. It then gradually died out, ending with three deaths in February. The second began in January 1733, and ended on August 2nd, causing 45 deaths. There had been an interval of barely 4½ years since the last time. But in fully three years again the disease appeared—in July 1736—and culminated in September, in which 23 deaths were due to it, among 30 from all causes; the total result being 66 deaths during the epidemic. It again appeared in February 1740, and extended through the summer, ending on August 3rd, after having caused 66 deaths. The year ending February 28th, 1744, had been a very healthy one, only 55 deaths having occurred from all causes, or at the rate of 12 per 1,000 per annum. But, in the following August, pox again showed itself, and wrought deadly havoc throughout the winter, causing

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74 deaths, of which 31 took place in January. It again raged from October 1749, till March 1750, causing 84 deaths, of which also 31 were in January. In the spring of 1754 the most severe of all the epidemics broke out, culminating in July and August, in which months there were respectively 39 and 33 deaths, in totals of 47 and 39 from all causes. The total mortality of the epidemic was 95. Two years and a half after its close, another began; but the harvest was not ready for the sickle. The interval had been too short, and the outbreak never attained great violence, though it lingered on for the unprecedentedly long period of 1½ years, causing 45 deaths in all. But in four years more a new generation of children had arisen, and 66 of these succumbed to the destroyer. Between these various epidemics, a few occasional cases occurred, amounting to 14 in the 36 years.

As showing the severity of the scourge, I may state that, in 7 of the 9 epidemics, the year's death-rate was actually higher than the birth-rate—in one year to the extent of 72 per cent. The figures are given in Table III.

TABLE III.

EPIDEMIC YEARS in which the TOTAL DEATHS exceeded the TOTAL BIRTHS.

Year.	Births.	Deaths from all Causes.	Deaths from Small-pox.	Excess of Deaths over Births.
1728–9	111	162	66	51
1736–7	135	147	66	12
1740–1	95	164	65	69
1749–50	134	149	79	15
1754–5	146	203	95	57
1757–8	125	132	37	7
1762–3	132	173	66	41
Total -	878	1,130	474	252

It may be profitable to compare the greatest Kilmarnock epidemic of modern times with the greatest to be found in the old register. In the year ending May 1874, 141 deaths from small-pox took place in a Kilmarnock of 24,000 inhabitants, being at the rate of 5·8 per 1,000 living. In 1754, 95 deaths took place in a population of 4,200, or at the rate of 22·6 per 1,000 living. The old epidemic was therefore four times more severe then the modern one. And it is to be remembered that, while the former had only a period of 4½ years in which to collect its victims, no serious epidemic had occurred for upwards of 30 years previous to 1874. One can hardly conceive what would be said now-a-days about an ordinary annual death-rate as great as that of what we have learned to look on as a terrible epidemic—one which anti-vaccinationists held to prove the futility of Jenner's discovery. And yet an annual epidemic equal to that of 1873–4 would do little more than represent the condition of matters in the last century.

In all, 622 deaths resulted from small-pox in the 36 years. The total deaths from all causes were 3,860. Of every 1,000 deaths, therefore, 161 were owing to small-pox.

* * * *

I wish now to call your attention to an important series of facts brought to light by the old register—namely, as to the age of the victims of these numerous epidemics. Table IV. shows that from

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the height of the first epidemic to that of the second one, was a period of 4 years 8 months. And of the 45 children who succumbed in 1733, 44 were less than 4 years 8 months old, the remaining one being 7 years of age. Thus only one child that died in the 1733 epidemic had been alive previous to the height of the 1728 epidemic. The disease had to secure its victims almost wholly from the population that had come into existence since its last visitation. One epidemic left almost no victims for its successors—in the same way, hardly any had been left to it by its predecessors. It called at every door, and nearly all who were not disease-proof came within its grasp.

TABLE IV.

Date of Epidemic.	Interval since height of former Epidemic.	Total Deaths.	Deaths in Children born since height of former Epidemic.	Deaths in Children who had passed safely through one Epidemic.	Deaths in Individuals who had passed through more than one Epidemic.
1728–9	Unknown	66	—	—	—
1733	4 yrs. 5 months	45	44	1	0
1736	3 „ 5 „	66	58	7	1
1740	3 „ 7 „	66	60	5	1
1744–5	4 „ 8 „	74	67	6	1
1749–50	5 „ 0 „	84	79	4	1
1754	4 „ 6 „	95	84	11	0
1757–8	3 „ 2 „	45	39	6	0
1762	4 „ 8 „	66	53	11	2
Cases occurring between Epidemics - -		14	8	5	1
Totals - - -		555	492 Or 88·6 per cent.	56 Or 10 per cent.	7 Or 1·2 per cent.

The leading fact shown by Table IV. is that, on an average, over 88 per cent. of those who died in one epidemic had been born since the previous one, that 10 per cent. who died had passed safely through one epidemic, and that only 1 per cent. had lived through more than one outbreak. In the 36 years only 3 deaths occurred in people over 20 years of age, one a lad aged 20, another a married woman aged 21, and the third, a dragoon, aged 26 years, who, from his occupation and name (Aspdal), was probably an "incomer" to the town, as the old registrar calls strangers, to distinguish them from the "indwellers" or settled inhabitants.

Table V. shows that practically these epidemics, to nearly nine-tenths of their extent, did not occur in a population of 4,200, but in a population of 475 persons. And the average number of deaths in this population was 60, or at the very high rate of 126 per 1,000 living, in each epidemic year. Now the number of attacks in unvaccinated children under five years of age is two for every death. As many die as recover. Therefore, of every 100 children born in Kilmarnock, no less than 25 were seized with small-pox at the first epidemic after their birth.

* * * * * *

TABLE V.

SECTION of POPULATION BORN since former EPIDEMIC.

Height of Epidemic.	Born since height of former Epidemic.	Died from various Diseases, excluding Small-pox.	Remaining to form field for new Epidemic.
May, 1733	614	90	524
October, 1736	476	82	394
May, 1740	501	89	412
January, 1745	506	68	438
January, 1750	634	107	527
July, 1754	648	131	517
September, 1757	445	41	404
May, 1762	690	110	580
Totals	4,514	718	3,796
Averages	564	89	475

Tables IV. and V. show that, as regards small-pox, there were, in fact, three Kilmarnocks. One, a Kilmarnock of 3,700 persons, had no fear of its attacks. These had already met with and battled with the disease-fiend. On many were to be seen the marks of the conflict. Some were blind, some had lost their hearing, many were permanently injured in constitution, and very many were scarred and disfigured for life; and, for every one that conquered, another had fallen never to rise again. There was, indeed, a second Kilmarnock under the green sod of the kirkyard. The Kilmarnock which had reason to dread the epidemic's approach was a Kilmarnock the least able to meet it. It consisted of a band of little children, numbering less than five hundred in all. Every such group that came into existence had to face, within four or five years of birth, the most terrible physical enemy that it would ever meet; and, having fought the battle, some were added to the maimed and distorted who formed so large a portion of the population, and others were laid beside those who had been destroyed by former epidemics. One can barely imagine what must have been the feelings of a mother regarding these fearful visitations. Even when the town was free from the pestilence, there would be the constant foreboding of its all too certain coming; and when at last the first case occurred—when the doctor was called in, and pronounced the disease to be the dreaded pox—his words would be heard as a sentence of death to some member of almost every family containing little ones; and, as the news spread from house to house, with what a despairing clutch would each mother press her darling to her breast, and beg Almighty God to command the destroying angel to pass by her door! After the lapse of a hundred and fifty years, one can have little conception of the real meaning of a small-pox epidemic. But the old parish registrar has enabled us to apprehend something of its horror; and I venture to say that, if the anti-vaccinationists had their will, we would ere many years be again experiencing somewhat of the awful visitations which were so familiar in old Kilmarnock.

By the English life tables I find that, of every thousand children born alive, 2·3 may be expected to die of small-pox before reaching five years of age. In Kilmarnock, 116 of every thousand born were fated to die of the malady under the same age. This comparison gives the startling proportion of 1 to 35.

*   *   *   *

The earliest age at which the register shows small-pox to have proved fatal was 20 days, the greatest 26 years. By looking at the summations of the columns in Table II. you will see the number of deaths at each year of age. The mean age of those under one year was 7½ months. The mean or average age at death, of all the cases, was 2·62 years. In England, from 1848 to 1872, the mean age was 11·9 years. The difference between 2·62 and 11·9 is sufficiently striking. But in the earlier part of the 25 years 1848–72, vaccination was not compulsory. From data furnished me by Dr. Robertson, of the Register House, Edinburgh, I am enabled to state that the mean age at death, in Scotland, in the years 1873–4–5, was 19·7 years; and to Dr. Ogle of Somerset House, I am indebted for the fact that "the "mean age of the 14,554 persons who died from small-pox in England "and Wales, during the seven years 1873–79, has been found to be "19·98, or almost 20 years." * * * * If vaccination did nothing else, it would obviously confer an enormous boon on humanity, in increasing by 17 years the life of those who do finally succumb to the ravages of small-pox. In the absence of primary vaccination death occurs at an average of 2½ years after the birth of the child. In the absence of re-vaccination death takes place at an average of about four years after puberty. It is, of course, easily possible to be led astray by averages, but granting this, these facts still point to the propriety of re-vaccination at adolescence. This is also shown by statistics of deaths in Kilmarnock since 1855. From 1855 to 1864 inclusive, vaccination was optional, and by no means universally performed, and the mean age at death was 4·38 years. From 1865, when the Compulsory Vaccination Act for Scotland came into force, to 1879, inclusive, the mean age has been 20·1 years. This last rate practically refers to the epidemic of 1873–4, as after 1865 no death took place in Kilmarnock for six years. During the epidemic there were 141 deaths. Of the 24,000 inhabitants over 3,000 were re-vaccinated. And, so far as I can learn, not one re-vaccinated person was attacked by the disease. Certainly not one died of it. This is a very remarkable fact. The 3,000 among the 24,000 were like the Israelites in Egypt, when, with their lintels and door-posts stained with blood, they were passed over by the angel of death on his visit of desolation to the households of their oppressors.

I have said that the average age of those under one year was, in Kilmarnock, 7½ months. Now, Dr. Robertson, of Edinburgh, made, in one of the Registrar's blue books, a very interesting comparison as to the deaths of children under one year old. He found that from 1855 to 1864, when vaccination was only optional, the number of deaths from small-pox in children under one year old was very nearly equally divided between the two halves of the year. But when vaccination became compulsory at the age of six months, this grouping altered very much—about 79 per 100 being under six months, and only 21 between 6 and 12 months. The inference was that vaccination made the difference. But a third fact was needed to complete the comparison, namely, the proportion in each of the two half years when vaccination was totally unknown. This is supplied by the Kilmarnock statistics, and Table VI. gives the result.

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TABLE VI.

RATIO of DEATHS from SMALL-POX between 6 and 12 Months of Age, to 100 DEATHS from SMALL-POX under 6 Months, during THREE SELECTED PERIODS.

AGE.	1728–1763. Kilmarnock. Vaccination Unknown.	1855–1864. Scotland. Vaccination Optional.	1865–1879. Scotland. Vaccination Compulsory.
Under 6 months -	100	100	100
From 6 to 12 months -	491	103	26

The first ratio may be taken as the normal one of natural small-pox. It is a disease nearly five times as fatal in the second as in the first six months of life. But when modified in the second six months, by optional vaccination, the mortality decreases very much—from 491 to 103. And when vaccination becomes compulsory, as in the third period, the 103 becomes reduced to 26. This second half year is the first part of life on which the influence of vaccination is brought to bear on the prevalence of small-pox, and the result is a very clear proof of the value of the compulsory law.

One question remains to be considered—How far is the decrease in small-pox mortality to be attributed to causes other than vaccination? I am quite prepared to grant that improved hygiene and treatment have exercised considerable effect in this direction. But they obviously have no bearing on the facts shown in Table VI. And that they account for anything more than a fraction of the enormous general improvement—an improvement at the rate of nearly 20 to 1—I distinctly deny. The following Table shows the decrease that has taken place in the mortality from various zymotic diseases since last century:—

TABLE VII.

RATE per 1,000 per Annum of DEATHS from certain ZYMOTIC DISEASES in KILMARNOCK in 1728–64, and in ENGLAND and WALES in RECENT PERIODS.

DISEASE.	Rate in Kilmarnock, 1728–64.	Rate in England.	Rate of Decrease.
Measles - - - -	·615	(1861–71) ·4399	100 to 70
Whooping-cough -	·7671	„ ·5273	100 to 68
Fever (including Scarlatina) - - -	3·4722	„ 1·8474	100 to 53
Small-pox - -	4·1071	(1854–79) ·208	100 to 5

Deaths from small-pox, therefore, have decreased 14 times faster than from measles, 13 times faster than from whooping-cough, and 10 times faster than from fever.

In conclusion, allow me to re-state the chief facts I have endeavoured to set forth.

(1.) Small-pox was epidemic in Kilmarnock every 4¼ years.

(2.) Its death-rate per 1,000 per annum was nearly 20 times greater than it now is.

(3.) Its death-rate under 5 years of age was 35 times greater than it now is.

(4.) The mean age at death from small-pox was 2½ years in the last century, and is now nearly 20 years.

(5.) The death-rate from small-pox in the second half-year of life is now only a fourth of that in the first half year, while formerly, in the second half year, it was nearly 5 times as great as in the first half year.

(6.) The small-pox death-rate has improved about 12 times as fast as the death-rate from measles, whooping-cough, and fever.

No. 8.

Reprint from Parliamentary Return, 1884. (Mr. Burt.)

RETURN of the Average Annual Strength of the ARMY, from 1860 to 1882 respectively, showing for each Year the Number of DEATHS from SMALL-POX, together with the Ratio per 1,000 of such DEATHS, and the Number of MEN entering the Service in each Year.

Year.	Average Annual Strength.	Number of Deaths from Small-pox.	Ratio per 1,000.	Number of Men entering the Service in each Year.
1860	203,017	30	·15	20,725
1861	195,281	43	·22	7,591
1862	196,349	20	·10	4,603
1863	196,239	18	·09	6,417
1864	191,057	36	·19	15,309
1865	184,503	27	·15	14,293
1866	175,323	7	·04	12,649
1867	174,614	6	·03	16,577
1868	173,031	3	·02	14,696
1869	163,905	18	·11	11,089
1870	155,945	9	·06	25,473
1871	171,455	36	·21	24,198
1872	171,956	24	·14	19,400
1873	169,744	13	·08	17,336
1874	169,014	8	·05	22,086
1875	169,235	3	·02	19,216
1876	169,197	2	·01	30,390
1877	174,884	6	·03	30,966
1878	185,006	15	·08	30,776
1879	164,642	3	·02	27,191
1880	159,622	2	·01	27,314
1881	173,331	3	·02	26,922
1882	174,557	5	·03	26,129

22nd July 1884.

T. CRAWFORD, D.G.

RETURN of the Mean Strength of the NAVY in each Year, from 1860 to 1882 respectively, showing for each Year the Number of DEATHS from SMALL-POX, together with the Ratio of such DEATHS per 1,000, and the Number of MEN entering the Service in each Year.

Years.	Mean Strength.	Small-pox.		Number of Entries.
		Number of Deaths.	Ratio per 1,000.	
1860	79,018	26	·32	13,038
1861	78,114	26	·33	11,493
1862	74,316	18	·24	10,744
1863	70,888	18	·25	10,908
1864	70,031	36	·51	9,163
1865	67,890	15	·22	9,293
1866	67,054	9	·13	10,503
1867	68,509	15	·21	9,804
1868	66,278	3	·04	6,406
1869	62,038	5	·08	6,510
1870	60,017	1	·01	8,027
1871	60,372	16	·26	6,949
1872	60,019	12	·19	6,940
1873	59,332	2	·03	7,281
1874	58,796	2	·03	8,143
1875	58,711	1	·01	7,426
1876	59,402	6	·10	7,474
1877	59,553	—	—	7,975
1878	60,111	—	—	6,483
1879	58,525	14	·23	6,806
1880	57,946	1	·01	7,596
1881	57,272	3	·05	6,107
1882	57,067	2	·03	6,998

JOHN W. REID, Director-General.

Deaths by Small-pox in the Metropolis, 1884.

No. 9.

Deaths by Small-pox in the Metropolis, 1884.

Ages.	In Hospitals.			In Private Dwellings.			Total.			Grand Total.
	Vaccinated.	Unvaccinated.	Doubtful.	Vaccinated.	Unvacinated.	Doubtful.	Vaccinated.	Unvaccinated.	Doubtful.	
0 to 1 year -	2	71	1	5	50	2	7	121	3	131
1 „ 5 „ -	10	100	20	5	23	6	15	123	26	164
5 „ 10 „ -	9	63	35	7	9	7	16	72	42	130
10 „ 15 „ -	21	33	24	4	6	6	25	39	30	94
15 „ 20 „ -	40	33	27	11	3	3	51	36	30	117
20 „ 30 „ -	125	51	53	15	5	16	140	56	69	265
30 „ 40 „ -	85	29	29	12	8	14	97	37	43	177
40 „ 50 „ -	45	20	22	8	2	2	53	22	24	99
50 „ 60 „ -	23	5	9	4	1	5	27	6	14	47
Above 60 years	7	4	1	1	—	6	8	4	7	19
Totals -	367	409	221	72	107	67	439	516	288	1,243
		997			246			1,243		

(*See* note on next page.)

No. 10*a*.

ANALYSIS of the RECORD of a THOUSAND CONSECUTIVE DEATHS by SMALL-POX in LONDON registered during 1884–5.

YEARS OF AGE.	AGES AT DEATH AMONG PERSONS																		Total.	
	Born in London.						Born out of London.						Birthplace not learnt.							
	Vacci-nated.		Not Vacci-nated.		Vacci-nation not stated.		Vacci-nated.		Not Vacci-nated.		Vacci-nation not stated.		Vacci-nated.		Not Vacci-nated.		Vacci-nation not stated.			
0–1	1	13	91	235	7	23	–	1	–	16	1	6	–	2	8	22	–	5	108	323
1–2	2		21		–		1		2		–		–		1		–		27	
2–5	7		55		5		–		8		4		–		5		2		86	
5–10	3		68		11		–		6		1		2		8		3		102	
10–15	6	117	31	72	12	49	2	136	13	78	1	78	4	60	8	35	5	52	82	677
15–20	20		13		14		12		9		7		2		5		6		88	
20–30	41		22		14		52		27		28		21		10		12		227	
30–40	35		3		7		34		11		25		19		7		8		149	
40 & upwards	15		3		2		36		18		17		14		5		21		131	
Total -		130		307		72		137		94		84		62		57		57		1,000

(See record on opposite page.)

[Note that IN THESE TABLES, 10(*a*) and (*b*), the assertion by relatives that a person was vaccinated has been held to entitle the case to a place among the vaccinated, no matter though the operation may have been performed during the incubation of small-pox, too late for any influence on the small-pox. Usually and in the foregoing Table 9, if any person takes small-pox while unvaccinated and subsequently has the operation of vaccination performed, the case is classed, where it is more proper to class it, among the unvaccinated.]

No. 10*b*.

Record of the Ages at Death, in a thousand consecutive fatal Cases of Small-pox; registered during the epidemic of 1884-85, as occurring among the Inhabitants of London, whether at their Homes or in Hospitals. Arranged to show facts as to Birth-place and Vaccination.

[*The facts as to Vaccination were ascertained by Vaccination Officers' inquiry from parents and relatives, whether or not they were stated in death certificates; where there could be room for question about the facts, the case is recorded along with those where the vaccination was not learnt. The facts as to birth-place were given by parents and relatives.*]

All ages are stated in years; except ages over three months and under one year, all of which are denoted by a colon (:); and ages under three months, all of which are denoted by the symbol ×.

A. Among Persons born in London:

a. and stated *to have been vaccinated*—

	34	3	19	30	27	29	:	3	4	18	32	29	20	31	17	14	39	4	29	1	62	17	52	40	48	20
	29	28	29	15	24	21	32	42	10	47	20	37	51	11	29	36	24	15	24	36	37	15	12	42	44	32
Ages	46	49	57	29	39	15	47	17	25	33	19	38	24	26	29	7	28	30	13	50	22	26	17	31	16	22
	52	52	32	34	25	22	24	2	30	28	30	36	36	23	11	18	29	23	16	39	32	20	17	22	32	24
	4	21	17	23	39	33	23	32	2	5	16	33	45	19	6	15	31	29	32	18	4	22	25	36	30	41

b. and stated *not to have been vaccinated*—

	8	27	16	13	3	:	×	6	2	3	9	17	6	42	:	3	6	:	5	11	1	6	×	1	×	2	:	×	5	:	1	:	×	×	:	×	3	18	5	1	×	3	×	21	7	8	5	12	15	:	×	:	13	6	5	3	2	12	9	:	1	1
	:	5	2	:	×	×	4	7	6	2	9	21	22	8	14	2	8	2	5	13	8	×	6	:	×	5	3	1	×	4	19	3	5	×	1	2	22	13	7	19	1	13	12	4	25	×	2	3	×	:	1	×	×	5	:	8	7	9	3	5	:	:
Ages	×	×	6	6	5	15	2	11	:	×	1	21	9	27	2	3	:	9	8	7	:	1	:	37	:	20	1	2	2	8	13	2	7	:	41	7	11	37	:	14	1	9	×	10	5	21	×	12	:	:	17	1	×	×	6	10	21	7	1	1	8	5
	:	×	1	×	3	×	2	:	7	3	8	2	12	:	13	4	5	25	2	20	:	24	18	7	20	:	×	1	3	1	:	6	17	5	×	17	18	5	23	23	×	13	3	6	9	2	:	×	×	7	:	×	×	6	5	13	:	×	26	7	4	2
	27	:	2	×	7	21	12	2	3	9	12	4	:	2	8	7	×	:	×	:	13	5	10	1	×	4	×	28	2	10	:	:	3	27	14	:	×	14	5	19	7	16	2	6	4	×	:	:	:	51	9	13	3	:	1	×	3	19	29	6		

c. as to whose vaccination *no statement* made—

	4	13	10	30	16	5	10	17	32	13	12	5	22	43	55
	3	36	18	:	6	:	31	29	7	:	19	×	32	5	13
Ages	19	35	18	32	17	25	3	:	14	15	15	4	:	9	7
	27	16	15	14	15	10	21	11	7	23	×	5	28	20	17
	20	18	23	17	8	7	29	21	35	21	23	3			

B. Among Persons not born in London:

a. and stated *to have been vaccinated*—

	30	37	25	40	45	44	42	37	52	21	25	39	1	38	64	27	22	32	38	44	21	52	21	22	42	18	19	14
	34	25	35	48	16	20	43	44	18	21	19	43	45	38	28	28	24	64	26	39	21	26	31	31	21	29	26	19
Ages	24	28	34	26	49	61	33	31	47	52	23	28	29	27	24	27	24	27	25	29	16	19	24	54	33	24	55	19
	44	42	35	39	45	36	45	28	38	20	35	22	31	40	39	16	28	21	33	23	29	27	20	32	26	26	42	30
	45	33	23	34	30	42	42	31	31	42	16	44	26	42	11	44	17	33	25	29	21	57	32	21	54			

b. and stated *not to have been vaccinated*—

	31	26	64	60	20	8	38	13	35	18	5	25	24	5	47	29	35	11	29
	43	36	23	4	12	29	22	33	28	4	10	24	28	38	4	3	7	40	17
Ages	11	20	4	23	4	1	1	18	48	46	16	54	32	11	9	65	32	12	14
	29	4	15	19	54	23	16	26	45	14	40	27	27	26	29	22	20	76	13
	39	52	12	50	12	22	25	58	17	37	19	48	7	2	24	25	40	14	

c. as to whose vaccination *no statement* made—

	3	30	37	43	26	46	51	37	3	25	20	25	20	21	32	16	36
	25	39	54	54	27	63	30	26	21	32	30	32	24	29	23	24	27
Ages	21	61	20	12	23	34	39	35	36	25	28	24	67	:	22	29	45
	40	26	38	43	30	39	60	34	26	27	17	19	39	72	31	21	23
	30	39	38	18	72	32	4	41	64	3	35	41	15	19	18	6	

C. Among Persons whose birth-place was not learnt:

a. and stated *to have been vaccinated*—

	9	25	55	21	29	33	23	20	27	37	46	43	32
	38	35	22	63	33	11	30	26	19	32	12	25	39
Ages	45	37	26	29	33	10	29	22	26	45	63	40	28
	50	10	44	26	22	37	40	36	28	30	32	61	20
	23	38	19	32	57	32	24	53	7	37			

b. and stated *not to have been vaccinated*—

	:	53	13	28	19	3	11	28	22	29	:	22
	4	17	6	:	46	49	18	30	36	49	31	×
Ages	16	21	×	:	38	29	×	7	18	13	8	30
	10	4	14	26	13	5	24	10	28	5	2	12
	54	34	7	:	1	8	2	6	35			

c. as to whose vaccination *no statement* made—

	56	72	22	15	41	28	8	44	48	10	60	46
	36	41	51	50	10	24	53	21	30	42	29	21
Ages	19	52	15	3	7	42	27	20	30	50	17	41
	7	12	35	6	40	19	31	22	30	12	24	52
	4	60	26	59	38	80	27	39	19			

Note.—Particulars are hereunder given of the seven children under one year old, born and dying in London, whose vaccination is nevertheless classed as *not stated:*

Child, aged 4 weeks; no information; died at home. Child, aged 4 months; unvaccinated (registered), vaccinated whilo mother in Small-pox Hospital (V.O.); died on board ship "Atlas." Child, aged 9 months; vaccination doubtful ((registered); vaccinated 8 days before small-pox appeared (V.O.); certificate of successful vaccination forwarded; died on board ship "Atlas." Child, aged 17 days; no information; died at home. Child, aged 4 months; "said to have been vaccinated at Small-pox Hospital when taken there with mother" (V.O.); died on board ship "Atlas." Child, aged 9 months; vaccinated (registered); unvaccinated (V.O.); died at home. Child, aged 3 months; unvaccinated (registered); vaccinated, taking in 4 places; small-pox appeared 6 days after the vaccination (V.O.); died on board ship "Atlas."

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